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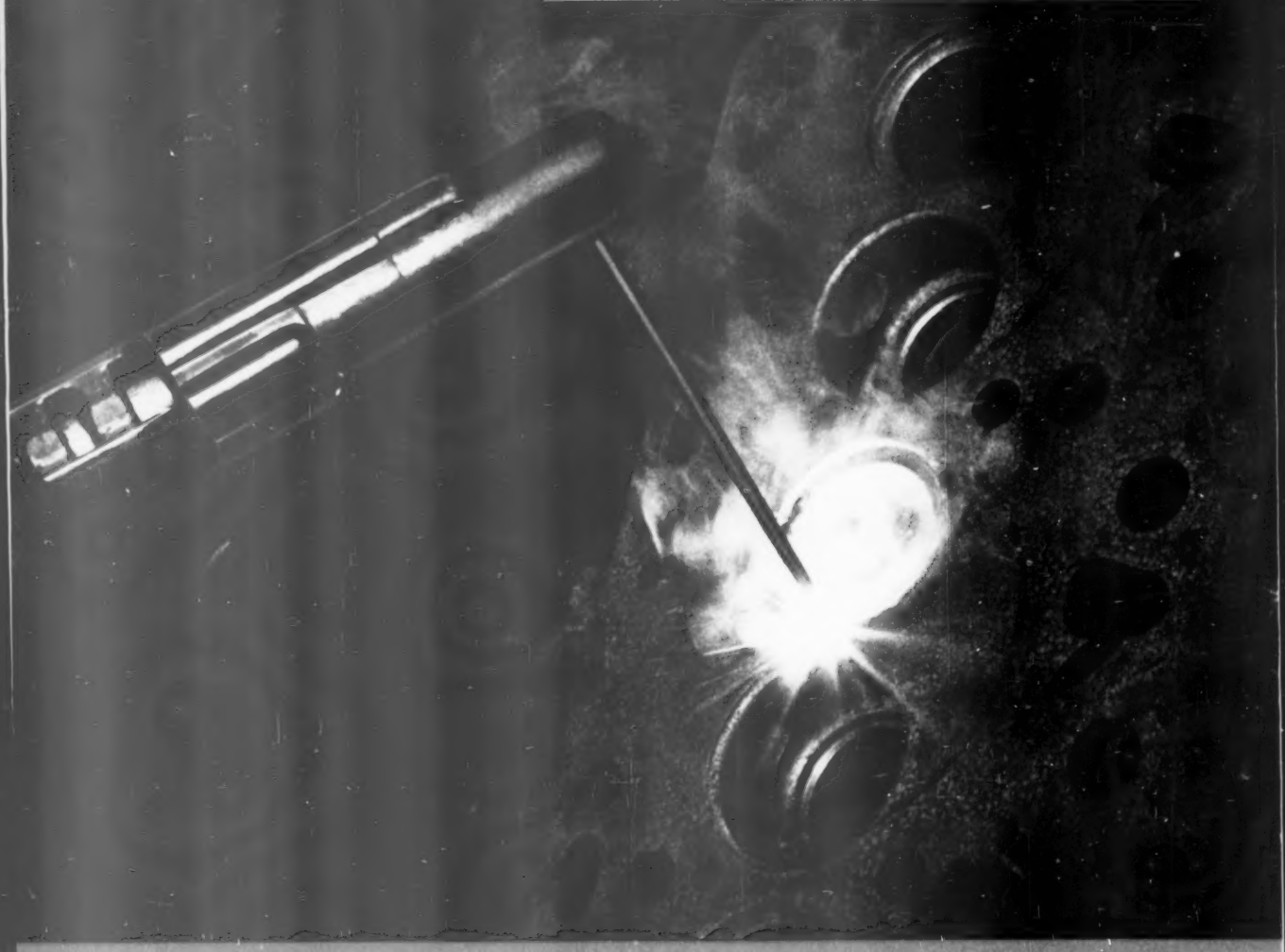
DECEMBER 1954

Welding Engineer



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A McGRAW-HILL PUBLICATION

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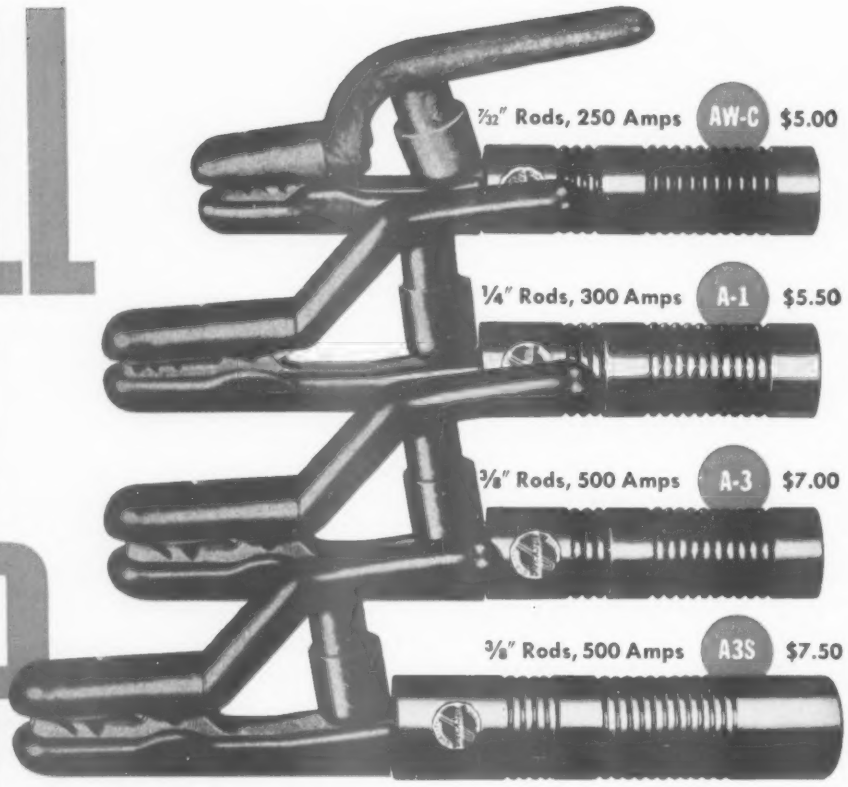

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	Tensile Strength lbs. per sq. inch	Elongation	Hardness Rockwell 'B'	Electrical Conductivity
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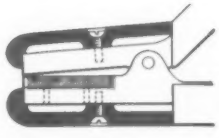

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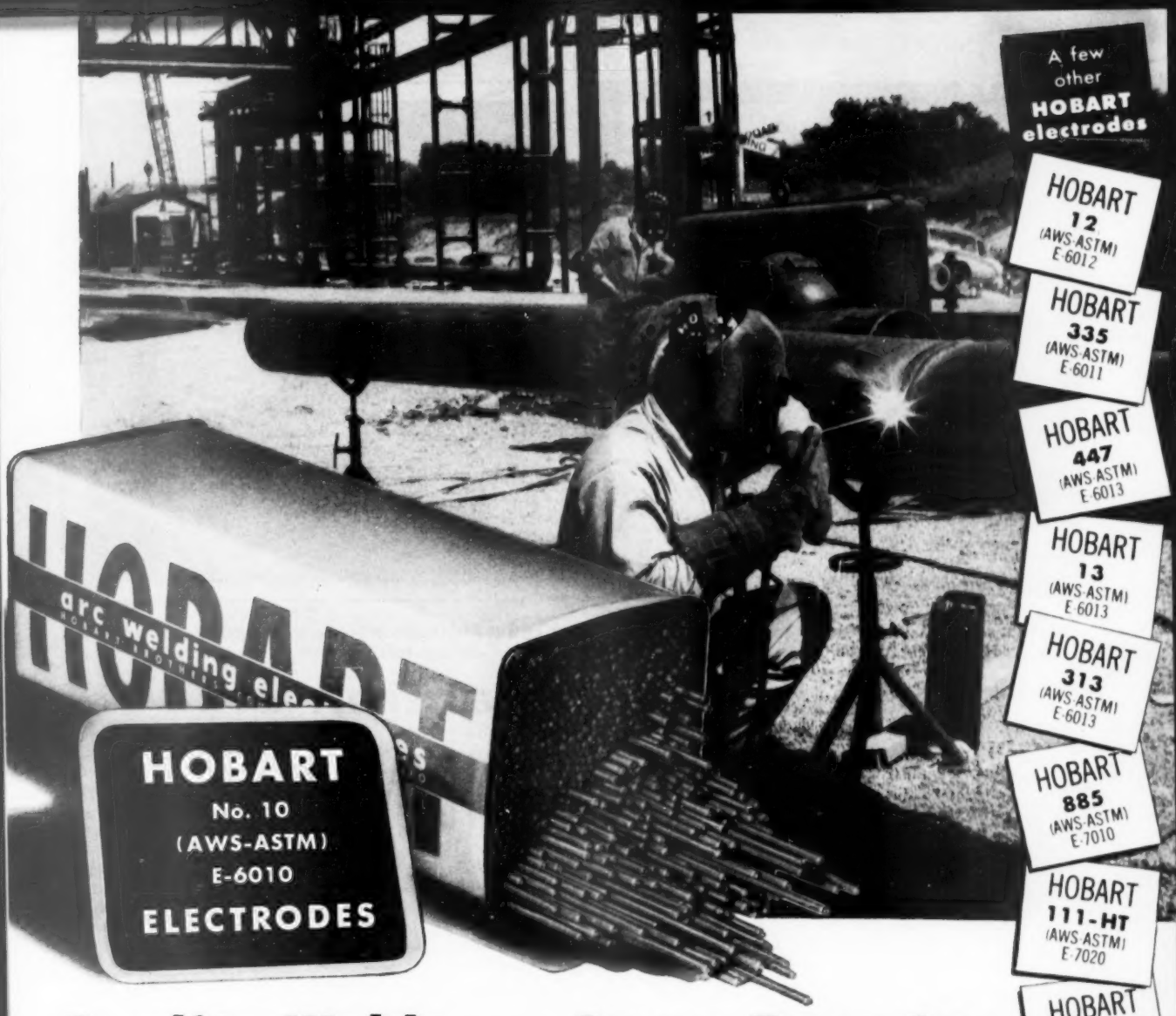

A few other **HOBART electrodes**

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- **HOBART 313** (AWS-ASTM) E-6013
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- **HOBART 111-HT** (AWS-ASTM) E-7020
- **HOBART ROCKET 24** (AWS-ASTM) E-6024
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- **HOBART 816** (AWS-ASTM) E-8016

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VOLUME 39 NUMBER 12

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DECEMBER, 1954

Cover: *Weldor Matthew Schuman builds up a valve seat for a bus engine of the Niagara Frontier Transit System. See page 36.*

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VICTORTUBE "SPECIAL"	Abrasion, severe impact	Oilfield bits, rock bits	Acety. only
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VICTORITE	Earth abrasion or sliding friction	Plowshares, cultivators, steel mill guides, cement chutes, shaft bearings, rolling mill guides	Acety. AC-DC Elec.
TUBE VICTORITE	Abrasion, impact	Plow points and farm tools	Acety. AC-DC Elec.
VICTORITE 1	Corrosion, heat, abrasion	Saw teeth, carbon scrapers, wire guides, rocker arms, steel mill applications	Acety. AC-DC Elec.
VICTORITE 6	Red heat, impact, corrosion and abrasion	Blanking, forming and trimming dies, cams, hot punches, pump shafts	Acety. AC-DC Elec.
VICTORITE 12	Heat, abrasion, impact	Saw blade inserts and other critical applications	Acety. AC-DC Elec.
VICTORITE CARBON ARC	High abrasion, thin deposit	Plowshares, lister shares, sweeps	Carb. arc Acety.
VICTORALLOY	Abrasion, severe impact	Tractor rollers, dredge pump impellers, bucket lips and teeth, rock crushers, steel mill wobblers, roll crushers	Acety. AC-DC Elec.
VICTORALLOY #1	High abrasion, medium impact	Bucket lips, rock crushers, Muller tires, gyratories	Acety. AC-DC Elec.
VICTORALLOY "A"	Angular shock, extreme impact, build-up	Clutch parts, gears, crusher plates, gyratory mantles, build-up for hardfacing	AC-DC Elec. only
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VICTORALLOY "C"	High abrasion, moderate shock and impact	Tractor grousers, pressure rolls, crusher segments, roll crusher teeth	AC-DC Elec. only

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For Automatic Application

THIS TYPE	FOR THESE CONDITIONS	ON THIS KIND OF EQUIPMENT
VA #1	Abrasion, medium impact	Crusher rolls, crushers, gyratory crushers
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VA #4	Multiple layer build-up	Tractor rails, crane wheels, general build-up
VA #5	Heavy impact, abrasion	Tractor rollers, idlers, mine car wheels, sheave wheels
VA #6	Medium abrasion, high impact	Crane wheels, drums, roll necks
VA #7	Abrasion, high impact	Build-up for hardfacing
VA #8	Abrasion, medium impact	Dozer bits, roll crushers, scraper blades
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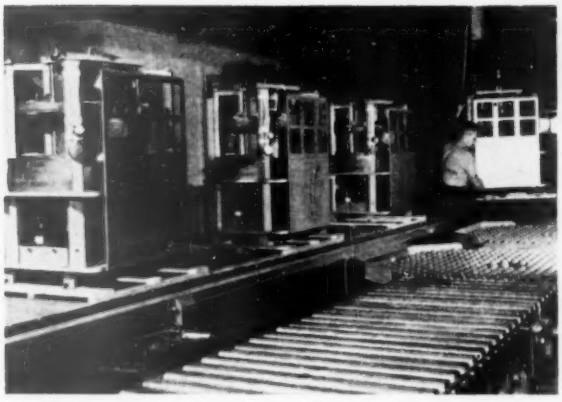
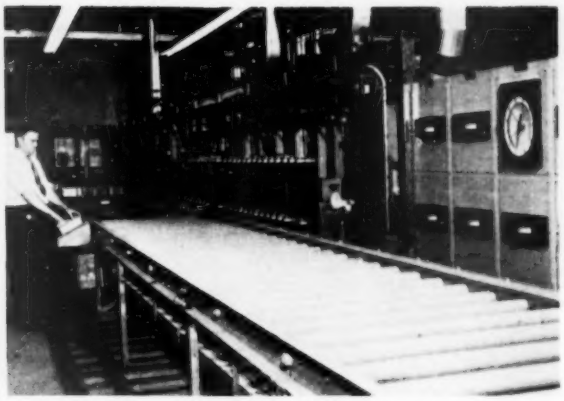


RECTIFIER d-c welders move from test area to final assembly in G-E Welding Department's new plant at York, Pa.



ANNEALING oven at recently opened site is completely automatic. Only one setting is required to start operation

NEWS

Midwest welding conference Feb. 8-9 at IIT in Chicago

LATEST research findings and unique applications of welding processes will be discussed Feb. 8 and 9 at the first Midwest welding conference at Armour Research Foundation of Illinois Institute of Technology, Chicago.

The Foundation and the Chicago section of the American Welding Society are co-sponsors of the event. More than 250 persons are expected to attend to hear researchers and users alike discuss these two areas of welding. Conference sessions will be conducted in the Metallurgical and Chemical Engineering building, 10 W. 33rd St., on IIT's campus.

Orville T. Barnett, the Foundation's supervisor of welding research, said that 75% of the program will be devoted to reports on actual welding applications by persons "who have shown exceptional ingenuity in their use." Other portion of the talks will cover latest research findings.

Members of several AWS sections throughout the Midwest have been invited to attend the conference, which is expected to become an annual affair. Further details will be announced in January.

* * *

NWSA announces special convention committee

A SPECIAL convention committee to complete arrangements for the National Welding Supply Association's 11th annual convention has been announced. The convention will be held May 18, 19 and 20, 1955, at the Edgewater Beach Hotel, Chicago.

Chairman of the committee is E. C. Caluwaert, of O.K.I. Welding Supply Co., Cincinnati. Other members are: Les Doughy, of Superior Welding Supply Co., Milwaukee; H. R. McGarvey, of H. R. McGarvey, Pekin, Ill.; A. J. Fausek, of Modern Engineering Co., St. Louis; F. J. Hupertz, of Calumet Welders Supply, Gary, Ind.; N. C. Miller, of Miller Electric Mfg. Co., Inc., Appleton, Wis., and C. E. Dennis, of Sellstrom Mfg. Co., Chicago.

Copper shortage

TWIN actions by the Department of Commerce to alleviate the current shortage in domestic copper supplies and to maintain employment in copper-consuming plants were recently announced by Secretary Sinclair Weeks.

Government-accumulated copper released by the Office of Defense Mobilization will be distributed by General Services Administration on recommendations of the Copper Division of Business and Defense Services Administration. Mr. Weeks said that copper obtained under expansion programs authorized by the Defense Production Act was insufficient to meet in full current industrial requirements in copper-consuming industries. Distribution of copper in the DPA inventory is limited to companies facing shutdowns for lack of the metal. Such copper is released from DPA inventory, not the national stockpile.

Expansion program completed by G-E Welding Department

RECENT opening of General Electric Co.'s welding-equipment plant represents completion of a major expansion program for the Welding Department. The new facilities at York, Pa., make possible complete integration of the department's equipment-manufacturing operations, including standardization of products and mechanization of many manufacturing procedures, according to General Manager R. C. Freeman.

The move from Fitchburg, Mass., began early in 1954. The York plant was formerly operated by G-E's Wire and Cable Department, which has been moved to Lowell, Mass., and Bridgeport, Conn.

In order to provide needed floor space, the York site was modernized and two new buildings were built. Joining of former structures provides a straight-line production and material flow. Layout of manufacturing facilities is U-shaped. Assemblies flow along three main production lines on one side of the U onto a common conveyor, which carries them across to the sheet metal and finishing areas. Proceeding down the other side, welders are crated, warehoused and shipped.

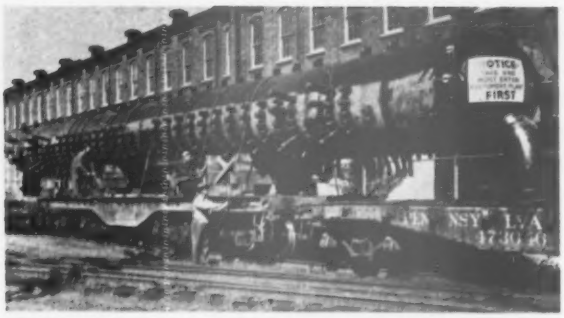
In addition to new lines of a-c and d-c rectifier welders, the plant is turning out d-c engine-drive and motor-generator sets, and equipment for Mig welding.

* * *

11 papers presented at meeting of Naval architects

ELEVEN papers were presented at six technical sessions of the 62nd annual meeting of The Society of Naval Architects and Marine Engineers, held last month in New York City.

NEWS . . . . . *from page 5*



UNUSUAL welded pressure vessel is 82 ft long and has steel walls almost 6 in. thick. Built by The Babcock & Wilcox Co., the 193-ton steam drum required three flat cars for trip to Detroit, where it will become part of largest single boiler in the world—15 stories high. It is destined for a Detroit Edison Co. power plant

SAFETY equipment for the welding industry as usual played large role in recent 42nd annual National Safety Congress and Exhibition. Gigantic affair was again held in Chicago, with technical sessions conducted in several downtown hotels. Exhibition, with 235 booths, attracted 12,000 persons

Acetylene Association changes convention date

BECAUSE the International Acetylene Association discovered that its annual convention would run simultaneously with the Western Metals Congress, the 1955 gathering has been moved a week ahead—March 22-24. It will be held at The Shamrock Hotel in Houston, as originally scheduled.

* * *

Welding-control firm changes hands

ENGINEERED Instruments, Inc., has taken over the facilities and operations of D-V Welding Controls, Oakland, Calif. The latter company's products have included specialized controls for automatic starting and stopping of motor-driven d-c arc welding equipment. These units will be manufactured in the Hayward, Calif., plant of Engineered Instruments and merchandised under the D-V Control name.

George C. Lydiksen will head sales of the D-V Control Division. Onetime sales engineer and general manager of the D-V firm, he has been sales engineer for Engineered Instruments for the past three years.

* * *

New welding machine shown at clinic

MORE than 325 persons attended a recent two-day welding show at County Welding Supply Co., New Rochelle, N. Y. Three color films were shown in the basement "theatre," and technicians demonstrated Linde equipment and processes used in hardfacing, air-acetylene heating, oxyacetylene cutting and inert-gas welding.

A machine which created a great deal of interest was the new single-phase "P&H" arc welder that produces, with the flick of a switch, either a-c or d-c current (straight or reverse polarity). Harnischfeger Corp. states the same machine can also be used for inert-gas welding.

* * *

RWMA, ICS collaborate on correspondence course

THE Resistance Welder Manufacturers Association is collaborating with International Correspondence Schools, Scranton, Pa., in preparing a correspondence course in resistance welding. The RWMA committee handling this matter is seeking authors, qualified by training and experience, who would be interested in preparing lessons.

* * *

Compressed Gas Association elects two new members

AT A recent meeting of its executive board, the Compressed Gas Association elected the following two firms to membership: H. Emerson Thomas Associates, Inc., Westfield, N. J., and Fisher Governor Co., Marshalltown, Iowa.

The board accepted the resignation of Air Reduction Magnolia Co., whose membership has been integrated with that of Air Reduction Co., Inc., New York City.

At the meeting the board also voted (*1*) to amend by-laws to establish a term of office for standing committee chairmen and to provide for selection of vice-chairmen; and (2) to develop standards for installation of bulk oxygen systems at consumer locations, and requested the president to name an appropriate technical committee.

Two NWSA zone meetings this month

TWO zone meetings of the National Welding Supply Association are on the December docket. These are the Southeastern Zone on Dec. 6-7 at the Dinkler-Tutwiler Hotel, Birmingham, Ala.; and the Southwestern Zone on Dec. 9-10 at the Hotel Skervin, Oklahoma City, Okla.

* * *

Sylvania changes to welded pins on fluorescent lamps

A CHANGE to welded base pins from soldered or crimped pins for fluorescent lamps has been announced by Sylvania Electric Products, Inc., New York City. Welded pins effect a positive metal-to-metal contact, eliminating the possibility of corrosion or contact resistance.

* * *

Soviets weld radio wires that formerly were soldered

To save the non-ferrous metal previously used for soldering wires in radio sets, the Soviets have developed a system for joining the ends of wires by electric welding.

The new method, now employed in the entire Soviet radio manufacturing industry, was described in a recent article by A. Jefimov, in the U.S.S.R. magazine *Radio*. Soldering, the article claims, connects two wires only at the surface, and thus makes for a poorer connection than when two molten wires are joined. The new method is also superior to soldering because breakage is much less probable than in the soldering process.

Two distinct methods are used today: the arc welding and the contact

(Continued on page 81)

here is an additional line every welding supply distributor can handle profitably

whether or not you are now handling our line of welding and flame cutting apparatus these many air-gas torches will be of interest to you and can be handled by you at a desirable profit. Our brochure No. 8 illustrates and describes equipment which is noncompetitive but supplementary.

Is natural gas scheduled to replace a manufactured gas in your territory? If so, we have something of special interest to you and your Gas Company. If this conversion has been made in the past, we have equipment your customers will be interested in. We have designed, produced and used torches and other items for the control of flammable gases since 1910; and we have cooperated with gas manufacturers and public utility companies for many years. Please look at the column to your right for a partial listing of some of the torches our brochure illustrates and describes in a colorful and interesting manner . . . **write for it today**

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ribbon flame burners for the glass blower and others . . .

crossfires for all fuel gases and either compressed air or pure oxygen . . .

small bench blowpipes for laboratories, radio technicians, electricians, orthodontists and others . . .

air-gas mixers for many purposes and in all capacities . . .

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cannon fires which can use many fuel gases with air or oxygen . . .

small air-gas torches for hand or bench use . . .

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540 DEPT. 143

NCG Torchweld® torches for Ferrojet cutting are available in models for either machine or hand cutting. Illustration shows the Ferrojet machine cutting torch adapted to the NCG Cut-O-Matic® portable cutting machine.

Riser pads on this stainless steel casting are being removed in half the time with the Ferrojet flame washing torch. It may also be used for removing cracks, chill bars, fins and sand inclusions from stainless and high alloy castings.

NCG FERROJET® Dispenser teams up with CUT POWDER-CUTTING

Mounted on a standard, two-wheel gas cylinder truck, the dispenser plus a cylinder of either compressed air or Nyrogen® make a mobile, easy-to-handle outfit. Dispenser does not require electricity . . . can be operated anywhere.

NCG Ferrojet Dispenser costs up to 70% less than expensive makes . . . gives unsurpassed performance

If it were possible for you to compare all the various powder dispensers, right in your own shop, on your own work, you would probably choose the NCG Ferrojet Dispenser. Here's why:

You save up to $600 on each dispenser you buy, because NCG's simplified dispensing principle provides a uniform flow of powder without using a complicated powder feeding mechanism. But low price is only half of the story.

Even more important than initial savings is its outstanding performance. For no other dispenser, regardless of cost, is capable of delivering more precise or uniform flow of powder. (And uniform flow, of course, is the basis of successful powder cutting.) No other dispenser is as easy to operate and maintain.

CHOICE OF TWO MODELS

In the automatic Model 301 Ferrojet Dispenser, gas pressures and amount of powder flow are maintained automatically. Special powder control operates simultaneously with turning-on and shutting-off of cutting oxygen valve on torch. Powder flow must be turned off manually on semi-automatic Model 302 Ferrojet Dispenser.

Ferrojet equipment is readily adaptable to machine cutting operations. Here a large diameter is being Ferrojet-cut from a 5½" thick plate by one of the country's large producers of cut-to-order stainless steel shapes.

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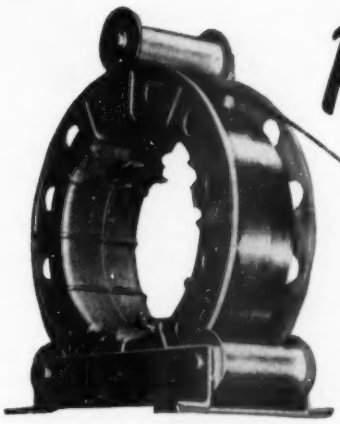

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ESTABLISHED 1916 **Welding Engineer** DECEMBER, 1954

Roadblocks to welding use

EVER since the first arc was struck in putting up the framework of a steel building, there has been a hesitancy about the use of welding for structural purposes that reminds me of a timid bather cannily sticking his big toe into the water at the lake's edge. He ought to know by this time that the temperature is just right for perfect swimming. He's been told often enough about the proved advantages of welding. Nevertheless, he has a feeling that perhaps he ought to stay back on the shore for a little while and continue to put up riveted structures.

It is little wonder that our timid bather hesitates when, to change the metaphor, one remembers the roadblocks that have been thrown up in the way of welding over the past 30 years. Weldors must be qualified as no riveters were ever required to be qualified. Welded joints must be inspected by X-rays or gamma rays as no riveted joints have ever had to undergo inspection.

Why? In heaven's name, why do they always want to restrict welding?

The only places where the use of welding is never questioned are where service conditions are too severe for any other fabricating process to stand up. In a steam generating station or in oil-refinery equipment that must operate at temperatures of 1,000 F and up and/or at pressures of 2,000 psi and up, nobody ever questions the reliability of welding. On submarines, subject to deep-level oceanic pressures, welding has been found satisfactory since 1918. But there are all too many old dodoes who view with fear and trepidation the fact that we have welded surface ships.

DESPITE what you have read in the newspapers, the truth of the matter is that the welded ship has proved itself over and over. Welded buildings have proved themselves, too, though there has been much less opportunity for them to do so. And so have welded bridges. Why, then, don't we have more welded buildings and bridges. I don't know, but I am beginning to wonder.

What is the real reason for the fantastic undercover opposition to the use of welding in the structural field? Can it be that influential figures in the steel mills and steel-fabricating plants are so shortsighted as to fight welding because it saves steel? I don't see how they can possibly be that shortsighted, but what other explanation is there?

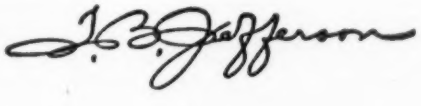
WHAT is the reason they are talking of changing the specifications of good old ASTM A-7 steel? Undoubtedly A-7 can be improved —as any steel can be—by closer control in its making; yet it appears satisfactory now for welded structures insofar as most fabricators and engineers are concerned. Why all this fussiness?

I ask you: Is someone trying to fool the country's structural engineers? Are they being subjected to a kind of "brain washing" that will keep them designing only bolted and riveted structures?

Incidentally, I am wondering what is in back of all the promotion in behalf of the new high-tension bolt. How does it happen that these high-tension bolts were found immediately acceptable? Welding was not; welding had to undergo many years of exhaustive testing and is still undergoing it. Yet I have not heard even one small voice suggest that the high-tension-bolted joint be X-rayed, trepanned, fatigue tested, pulled, twisted or bent. Apparently, it is is considered to be a gift from the gods, perfect from the moment of birth.

While I am asking questions, I would like to pose this one: Why do some members of various American Welding Society code committees sit back and let the same senseless old restrictions on the use of welding pass by unchallenged? Do they want to encourage or to hinder the use of welding?

Instead of playing footsie with those who would further hamstring welding, let's give them a great big kick in the pants. Let's talk up the advantages of welding for all we are worth and see if we can't gain an entrée into the highly exclusive club of structural steel building. Our greatest opportunity for growth as an industry lies in the construction of welded steel buildings and bridges. Are we going to keep on losing this valuable business without once putting up a fight for it?



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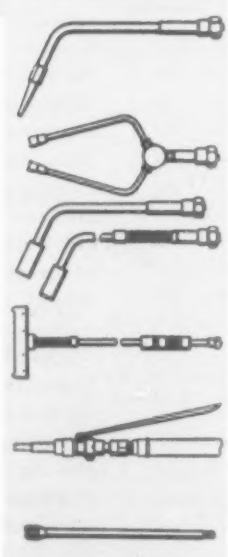

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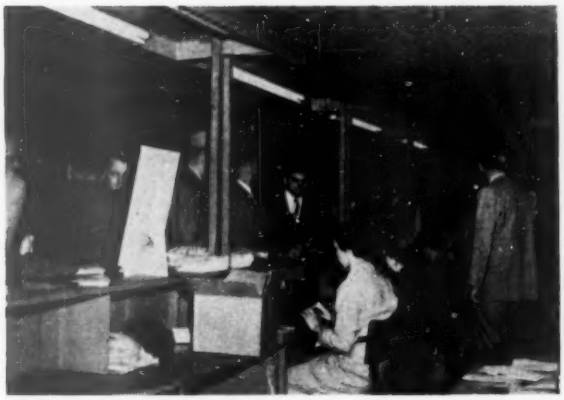


What happened in Chicago

A Mig arc-cutting process, carbon dioxide as a shielding gas, a "flame-stabilized" burner for oxypropane welding and cutting, the coming germanium rectifier, iron-powder electrodes . . . these are some of the highlights in this play-by-play account of the AWS Chicago fall meeting.

BY CLYDE B. CLASON

IN OPENING the 35th annual meeting of the American Welding Society, Fred L. Plummer, the retiring president, called attention to the Society's continued growth. During the past year, he pointed out, membership took an upward jump of 30%—from under 8,000 to 10,300—while the Society's budgeted income and expense has increased by 37%. These impressive accomplishments speak volumes for the quality of Mr. Plummer's two-year leadership.

An announced in October WELDING ENGINEER, Mr. Plummer is succeeded as AWS president by Joseph H. Humberstone, president of Air Reduction Sales Co., Inc. J. J. Chyle, director of welding research, A. O. Smith Corp., Milwaukee, is now first vice-president, and C. P. Sander, general superintendent of the Vernon, Calif., plant of Consolidated Western Steel Div., United States Steel Corp., is the new second vice-president.

AWARDS AND PRIZES

Outstanding achievements in the field of welding were acknowledged publicly at the opening session on Monday morning Nov. 1. Fred L. Plummer, 1952-1954 president of AWS, served as chairman of this general session, while the co-chairman was Walter Goerg, Jr. (assistant advertising manager, Air Reduction Sales Co.), the chairman of the AWS convention committee. Other awards were presented during the national dinner on Monday evening.

The Samuel Wylie Miller Memorial Medal, highest honor that the American Welding Society can bestow, went to A. F. Davis, vice-president and secretary of The Lincoln Electric Co., Cleveland. A rather large volume could be written on the contributions that "Charlie" Davis has made to the welding industry. He was elected to receive the Miller Medal this year for "his clear vision of the value of welding knowledge and his generous contribution to the promotion of education." A very good choice!

Absence this year of the annual RWMA awards left a serious gap in the award program. These annual awards for papers on resistance welding have been a feature of American Welding Society annual meetings since 1940. Here's hoping that the Resistance Welder Manufacturers' Association will see fit to resume them next year.

Professor A. A. Toprac, associate professor of civil engineering, University of Texas, was presented the Lincoln Gold Medal for a paper published in the *Welding Journal*, in January, 1954. His paper, "An Investigation of Welded Rigid Connections for Portal Frames," was judged to be the most original contribution to the "advancement and use of welding" published in the *Journal* during the 12-month period ending last July. Professor Toprac has been a member of the teaching and research staff of the University of Texas since 1950.

Harold O. Hill, assistant chief engineer, fabricated steel construction, Bethlehem Steel Co., was elected an honorary member of the American Welding Society. The honorary membership was awarded to Mr. Hill in recognition of his many years of service to the Society, including a term as president in 1947-48, and for pioneering work in the application of welding to steel structures.

The A. F. Davis Undergraduate Welding Awards for student papers on welding went to Otto P. Eberlein and Roger C. Waugh, of Cornell University (first prize), and to Richard Hayes, of Massachusetts Institute of Technology (second prize), as announced in WELDING ENGINEER, Oct., 1954. The team of Eberlein and Waugh had also captured first prize in the 1953 A. F. Davis Undergraduate Welding Awards. A pair of young engineers to watch!

The Henry Neitzel Membership Awards for AWS sections were presented during the national dinner

A. F. DAVIS (right), vice-president, Lincoln Electric Co., receives 1954 Samuel Wylie Miller Memorial Medal

WILLIAM L. WARNER receives Adams Lecture certificate from Fred Plummer (left), retiring AWS president

J. R. STITT (left) presents Neitzel bronze plaque to John T. Stewart, representing the New York Section

MARVIN J. BARNES (right) accepts Neitzel membership award on behalf of growing Oklahoma City Section

ceremonies on Monday evening. For the record, the New York section made the greatest net gain in number of registered members (132 net increase), and the Oklahoma City section made the greatest net gain percentagewise (110.3%).

Adams Lecture

William L. Warner, engineering research adviser, Watertown Arsenal, Watertown, Mass., delivered the annual Adams Lecture at the opening awards session on Monday morning. This lectureship, established to honor the founder and first president of the American Welding Society, is awarded each year to an outstanding scientist who has made a new or distinctive development in the field of welding. Mr. Warner was selected because of his noteworthy studies and evaluation of toughness in welds. His lecture, "The Toughness of Weldability," discussed the significance of toughness on the serviceability of welds and described methods of evaluating this important property.

A total of 56 papers were programmed for the 19 technical sessions, which extended from Monday afternoon Nov. 1 through Friday morning Nov. 5. Here are some of the highlights:

Mig Cutting Process

Aluminum, copper, nickel and other non-ferrous metals and alloys that normally resist oxidation in flame-cutting can be successfully shaped and severed by a new Mig (metal inert-gas) arc-cutting process, described by R. S. Babcock, of Linde Air Products Co.

The new cutting process employs essentially the same apparatus as the Mig welding process. Any standard welding gun for inert-gas metal-arc welding can be used, but water cooling is needed.

The consumable electrode is steel wire; 3/32-in. diameter No. 32CMS has been most extensively used in tests to date. The usable current range is between 450 and 900 amp, d-c, reverse polarity. The shielding gas best suited for Mig arc cutting appears to be argon, and flow rates are on the order of 20 cu ft per hr for average thickness conditions.

The cutting arc differs from a Mig welding arc mainly in its location. Whereas the welding arc extends from the tip of the wire, the cutting arc extends from the entire surface of the leading side of the wire, from top to bottom of the workpiece. The wire is fed so that its tip reaches the bottom or underside of the workpiece. If the tip of the wire is even with the bottom of the workpiece, the kerf or cut width will be uniform and the exhausting slag or dross will be more completely discharged. When the tip of the wire is closer to the top of the workpiece, the cut surface is top beveled and the slag will adhere to the bottom of the cut. Cutting can be

HONORARY membership in the American Welding Society was awarded to Harold O. Hill, of Bethlehem Steel Co.

PROFESSOR A. A. Toprac (right), University of Texas, receives the Lincoln Gold Medal from H. Malcolm Priest

ROGER C. WAUGH (left), Cornell University, accepts first prize in A. F. Davis Undergraduate Welding Awards

RICHARD HAYES (right), M.I.T., gets second prize in Davis awards from Walter Goerg, convention chairman

started either at the edge of the material or by piercing a hole through the plate.

Clean, bright metal surfaces are said to be produced at extremely high cutting speeds on aluminum and other non-ferrous metals and alloys. Satisfactory test cuts were made on ¼-in. plates of copper, brass and aluminum at cutting speeds of 60, 90 and 144 ipm. Other tests indicated that with a current of between 1,000 and 1,300 amp, ½-in. aluminum, ¼-in. copper and ½-in, magnesium can be cut at speeds of 100, 120 and 144 ipm. However, extremely high wire-feed rates are required to maintain the cutting action, and this points to the probable need for special apparatus to use with higher currents and at the higher speeds.

Carbon Dioxide Shielding

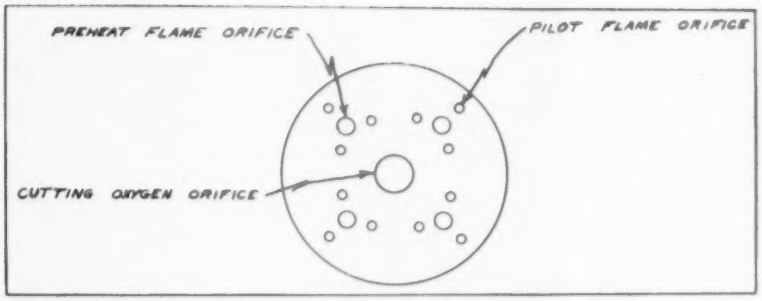
Just as carbon dioxide puts the zip into charged water, so is it going to put the zip in the inert-gas welding of mild steel, asserted Roger W. Tuthill, of General Electric Co. Considerable monetary savings are in prospect. Whereas it may now cost around $5 per hour for argon shielding, the same job can be done by carbon dioxide at a cost of around 25¢ per hour.

Chief drawback to present use of carbon dioxide shielding gas is its erratic arc action, resulting in excessive weld spatter. This can be overcome by using a short-arc technique and a constant arc length that will not change as the welding current changes. A high, hot and deeply penetrating arc is required. It is very important to use a high current density —between 100,000 and 200,000 amp per sq in. This means a current of 350 amp for a 5/64-in. electrode.

In the heat of the arc, carbon dioxide breaks down, first into carbon monoxide and then into constituent carbon and oxygen atoms. These escape through the molten weld metal and re-form into carbon monoxide and then into carbon dioxide again. However, not all of the carbon monoxide is changed back into carbon dioxide, and the residium of poisonous carbon monoxide creates an urgent need for proper ventilation of the welding area. Most of the carbon monoxide will be found in the smoke and fumes given off by the welding arc. For these reasons, the operator should never allow his face to impinge on the arc fumes so that he might accidentally breathe them. If the fumes are removed by the usual type of exhauster, however, there is no safety hazard involved.

Flame-Stabilized Burners

The advantages of the oxyacetylene flame for welding, cutting, flame-hardening, flame-cleaning, etc. are so pronounced that one tends to forget that acetylene pressure must be limit-



FIRST major change in the cutting-torch tip since its invention was described in the paper by E. H. Roper on flame-stabilized burners (see text)

ed to 15 psig. Other fuel gases, however, are not so limited in operating pressure.

A research program to develop burners that would use other fuel gases in the pressure ranges unavailable to acetylene was described by E. H. Roper, manager, technical market development section, Air Reduction Sales Co. The result of this research is the development of a new "flame-stabilized burner," which has been experimentally tested for flame-cleaning, flame-hardening, flame-cutting, flame-piercing, glass working and tube welding in a tube mill.

The principle of the stabilized burner is to surround the main flame with a ring of pilot flames burning propane. These small oxypropane flames, according to Mr. Roper, achieve three things:

1. Protect the main flame from the air.

2. Add an ignition source, and

3. Provide partial products of combustion, which increase the burning velocity of the main flame.

Taking a conventional oxyacetylene tip and a flame-stabilized oxypropane tip of the same port size, the flame-stabilized burner, operating at ten times the pressure, releases over four times the Btu output of the oxyacetylene flame. It would be interesting to know what the comparison would be if the oxyacetylene torch could be operated at the same pressure, but this would involve acetylene pressures much higher than legally permitted, and so such studies would not only be dangerous but pointless.

The flame-stabilized burner has resulted in the first major change to be made in the cutting torch since its invention. The new model surrounds each of four preheat orifices with three pilot-flame orifices (see sketch at top of this column).

Iron-Powder Electrodes

The comparatively recent field of powder-coated electrodes was deemed of sufficient importance to be assigned to two speakers. Both referred to tentative classifications of the AWS-ASTM Committee on Filler Metals for the new iron-powder electrodes.

According to D. L. Mathias, research engineer, Arcrods Corp., Sparrows Point, Md., three numbers have been reserved for these new electrodes: E-6014, E-6024 and E-6027. Proposed E-6014 is a rutile or titania electrode corresponding to present E-6013 classification. E-6024, also a rutile electrode, corresponds to present E-6012, while E-6027 is an iron-oxide electrode, corresponding to present E-6020. No numbers have as yet been assigned to iron-powder electrodes of the low-hydrogen type, although such electrodes are now being manufactured and would appear to offer important advantages.

Jerry Hinkel, of The Lincoln Electric Co., amplified Mr. Mathias' descriptions of the proposed three new electrode classifications. The tentative (and it should be emphasized that as yet there is nothing official about these numbers) E-6014 classification would cover an all-position electrode; E-6024, a modified E-6012 type, would be for flat butt joints and horizontal fillets; while the iron-oxide electrode E-6027 (similar to E-6020) would be best suited to deep-groove butt welds.

With regard to the proposed E-6014 specification, Mr. Hinkel said it should be referred to as a "nearly all-position electrode." A truly all-position electrode of the iron-powder type is almost an impossibility, he said, owing to the fact that the particular advantages of the iron-powder coating are lost when welding is performed in other positions than downhand. For this reason, he does not believe that powder-coated electrodes will ever be suitable for pipe welding, where frequent changes in position are necessary.

Both speakers were in agreement that the deposition rate can be substantially increased by use of iron-powder electrodes. This advantage over conventional electrodes lessens, however, with larger diameters.

The iron-powder electrode is not a cure-all, not a panacea for all welding ailments, but it does offer certain definite advantages when correctly applied. It has found a place of its own and is here to stay, but it will supplement rather than supplant conventional electrodes.

For more information see article, "New iron-powder electrodes," page 56, Nov. Welding Engineer.

Selenium vs. Germanium

An analysis of available rectifiers shows that selenium rectifiers are the best choice for welding service at the present time, declared G. K. Willecke, of Miller Electric Mfg. Co., Inc., Appleton, Wis.

On the basis of current-carrying ability, the only two classes of rectifiers that can be accorded any consideration are the vapor-arc rectifiers (ignitrons and thyratrons) and the metallic rectifiers: cuprous-oxide, magnesium-cupric sulphide, selenium and perhaps germanium.

The reason why vapor-arc rectifiers have never been commercially practicable for arc welders is that they operate most effectively at high voltages. Their use in arc welders at relatively low voltages has all the aspects of installing a high power aircraft engine in the family automobile.

Metallic rectifiers appear to be almost ideally suited for arc welding applications, with the top position presently being held by the selenium rectifier. The reason is the higher voltage rating of the selenium cell as compared to the oxide and the sulphide types.

Recently, however, another type of power rectifier has appeared that seems to show exceptional promise in the field under discussion. It is the germanium power rectifier, and it is characterized by phenomenally high current densities. A cell of 100-amp rating may have an active surface no larger than a quarter. Voltages are

RECEPTION line: Howard Biers, president of the International Institute of Welding; Mrs. Joe G. Magrath

L. C. MONROE (left), secretary, Chicago Section; Mrs. Monroe; Walter Goerg, convention committee chairman

also reported to be much higher than with selenium.

The main drawbacks to germanium rectifiers at the present time seem to be one of high cost and the fact that present production methods are very tricky. However, laboratory progress is being made rapidly.

In the welding field, it appears that the germanium rectifier—because of its high efficiency and compact size—will find its use in high-current automatic welding equipment. Germanium will, therefore, supplement the selenium rectifier rather than replace it. It will extend the range of usefulness of metallic rectifiers by supplying a relatively high voltage, very high current rectifier in a very compact package.

High-Nickel Overlays

When a high-nickel alloy is deposited on a steel or cast-iron surface, the overlay may be adversely affected if diluted with a large amount of iron. Practical methods for avoiding the "iron effect" were presented in the paper by George R. Pease, H. B. Bott and H. C. Waugh, all of International Nickel Co., Inc.

The metals involved in the test program included Monel, "K" Monel, nickel, Inconel and 80-20 nickel-chromium weld metal, deposited for the most part as a one- or two-layer overlay on a mild-steel base. A few exploratory tests were also conducted on ordinary gray iron. The metal was deposited by three methods: (1) manual arc welding with coated electrodes, (2) Mig (metal inert-gas) welding and (3) Tig (tungsten inert-gas) welding.

The conclusions of this research trio are:

Sound, ductile overlays can be obtained on mild steel, using coated electrodes of Monel, nickel or nickel-chromium, or the inert-gas consumable-electrode process with Monel, Inconel, "K" Monel or nickel wires.

High-nickel alloy overlays made by Tig welding have high iron contents and correspondingly poor properties. Other processes appear to be better suited.

The usefulness of any of the high-nickel alloy filler metals for overlaying cast iron appears to be extremely limited.

Mig Overlay Process

When Mig (metal inert-gas welding) is used for overlay work, there are several methods of securing the desired minimum penetration. These were described by C. R. Felmley, of Air Reduction Sales Co. Besides tampering with the obvious variables such as welding current, arc voltage, type of power supply and type of shielding gas, Mr. Felmley mentioned one method that is less known. This is to add an auxiliary cold wire to the welding arc and then oscillate the whole system.

When multiple arcs with auxiliary wires and oscillation are employed, metal deposition rates of 35 lb per hour for copper-base alloys, 30 lb per hour for stainless steel and 26 lb per hr for carbon steel can be obtained. A color movie was shown of the new a-c series-arc overlay technique.

Metallizing Symposium

A symposium on fused metallized coatings was held on Wednesday afternoon Nov. 3 under sponsorship of the AWS Committee on Metallizing. Chairman of the session was H. S. Hammond, Metalweld, Inc., and co-chairman was Walter B. Meyer, St. Louis Metallizing Co. Three papers were given.

Bela Ronay, U. S. Naval Engineering Experiment Station, discussed fundamentals, including historical investigations and experiments.

Harvey S. Miller, New England Hardfacing Co., Brookline, Mass., covered four stages of technique; namely, preparation of surface, spraying of deposit, fusing of deposit and finishing.

There are two principal methods of spraying the self-fluxing alloys: a wire gun and a powder gun. The wire gun is commonly known as a metallizing gun, in which the wire is fed into the flame. The nickel-chrome-boron alloys are too hard and brittle to be drawn into wire form and therefore cannot be used in a metallizing gun except in the form of cast wires, which are expensive and impractical. However, there has been developed a method of mixing the powdered alloy with highly volatile plastic (which leaves no solid residue after burning) and then extruding this mixture into $\frac{1}{8}$ in. and 3/16 in. wires. There is approximately 20% plastic binder in each pound of wire.

There are several different types of powder guns, but the principle is approximately the same for all. The powder is fed from a hopper or container by means of a carburetor, which is nothing more than a venturi. This allows an air jet to pick up the powder and propel it out through a hose to a gun, where it passes by a flame, is heated to its plastic range and is then blown onto the prepared

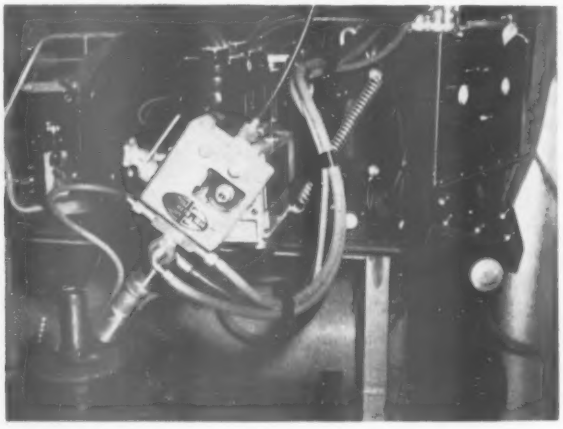
(Continued on page 44)

WELD inspection is one of industrial uses of 1,000,000-volt X-ray

EARPHONES were needed to hear what this piquant miss was saying

DUNKED in water, welder rectifier withstood double-load test

HUGE mock-up was one of the many devices used by exhibitors to make their booths more appealing to the eye



CARBON-dioxide was used as shielding blanket here. Manufacturer also demonstrated new cutting machine

Here's what we saw at the 36th

BY FELIX TANCULA

LOW-HYDROGEN, iron-powder electrodes. A Mig (metal inert-gas) spot-welding gun. A million-volt X-ray generator for industrial radiography. A welding outfit for the "do-it-yourself" workman. New lines of welders, including a-c and rectifier d-c types.

These and many more new items of welding equipment are what we and about 63,500 others saw in Chicago early last month at the 444-exhibit metal show. Site of the 36th Annual National Metal Congress and Exposition was the International Amphitheatre, on the Windy City's south side. The show ran concurrently with the national fall meeting of the American Welding Society (see page 17), Nov. 1-5. About 263,000 sq ft of floor space were needed to house the huge displays of equipment, products and services.

Probably the most universal new product displayed and demonstrated was the low-hydrogen electrode with powdered iron in its coating. Among the firms showing it were General Electric Co. and Alloy Rods Co.

The manual Mig spot-welding process was introduced by Linde Air Products Co. Requiring access to only one side of the weld joint, the gas-shielded method makes spot, plug and tack welds with addition of reinforcing filler metal. A consumable wire electrode is fed automatically into the weld area, and filler metal is claimed to make a 100% penetration in the lapping metals. The pistol-like welder is designed to operate most effectively with a constant-potential power supply.

In operation, the weldor places the nozzle of the water-cooled gun on the work and pulls the trigger. Argon gas blankets the weld area just before the arc is struck. As the arc strikes, a portable drive unit feeds coiled wire into the weld at a predetermined rate. Welding current and argon flow are shut off by a timer.

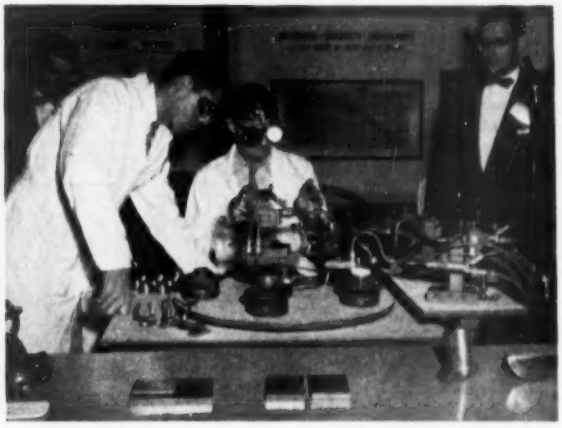
The 1,000,000-volt X-ray apparatus

SPOT weld was made by means of a new Mig gun that uses filler wire

SUBMERGED-arc set-up was powered by constant-voltage arc welder

BALL stayed mysteriously aloft, even when compressor outlet moved

FLASH of stud-welding gun is caught by camera as operator demonstrated its use to a throng of passers-by



FIXED torches and an indexing fixture were used in display of mechanized hardfacing. Samples are in front

Metal Show

uses the electrostatic principle of the Van de Graaff generator, which found fame in the pre-cyclotron days of atom-smashing. The manufacturer, High Voltage Engineering Co., claims exposure time for penetrating 1½-in. steel is less than 1 minute; for 4½-in. steel, 30 minutes.

Among equipment displayed by The Lincoln Electric Co. were the 100-amp welder and other components of a simplified welding system that was announced in WELDING ENGINEER for October. It enables "do-it-yourself" hobbyists and craftsmen to work with metals as readily as with wood, according to Lincoln.

Its new rectifier d-c welder was displayed by Vickers Electric Division of Sperry Corp. Added feature in this booth was the dunking in boiling water of a 40-volt rectifier, which operated at double the rated load.

Another eye-catching device was seen in the Nelson Stud Welding booth. A large mock-up of its new streamlined, pistol-shaped welding gun moved back and forth, simulating actual operation even to arc flash (an electric light).

As in the past, the show had its share of eye-appealing booths, the gimmick-type exhibits, the test-your-intelligence type, the guess-how-many type and many other large and small displays. These many interesting exhibits more than compensated for the sore feet your WELDING ENGINEER editors complained about afterwards.

It wouldn't be a familiar metal show without pretty girls, and a number of attractive things adorned the booths of several manufacturers. (Westinghouse sure can pick 'em; we refer you to the picture on page 22.)

These are just a few of the high spots of the show. There were many more, but lack of space makes it impossible to mention all manufacturers in the welding field that participated in the gigantic Chicago exposition. Many of their products will be found in the "new product" pages of forthcoming issues of WELDING ENGINEER.

How design control

BY REX CLEVELAND
Design Engineer, Minneapolis-Moline Co., Louisville, Ky.

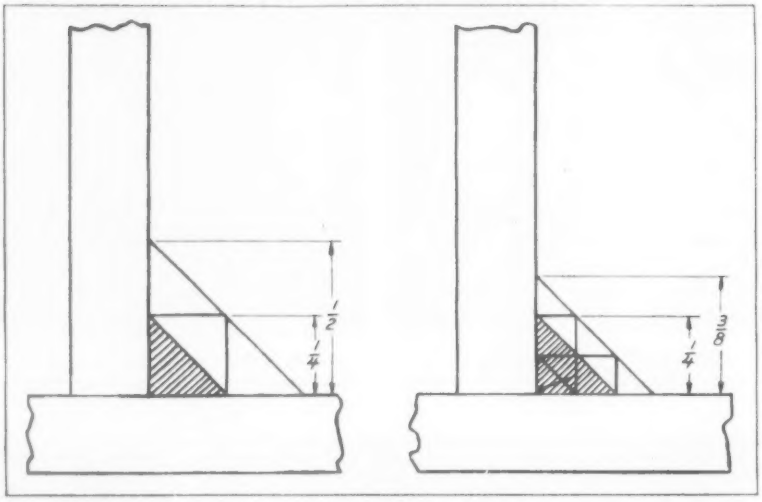
THE ULTIMATE cost of any product is largely determined by its design. Particularly is this true of welded products, for the present high cost of welding labor mushrooms costs very rapidly.

Basically, the designer must think of welding as a method of fusing parts together, not as another means of fastening them. This means that weldments must be designed specifically for welding. Simply replacing bolts or rivets with welds is not enough if the full cost saving is to be effected.

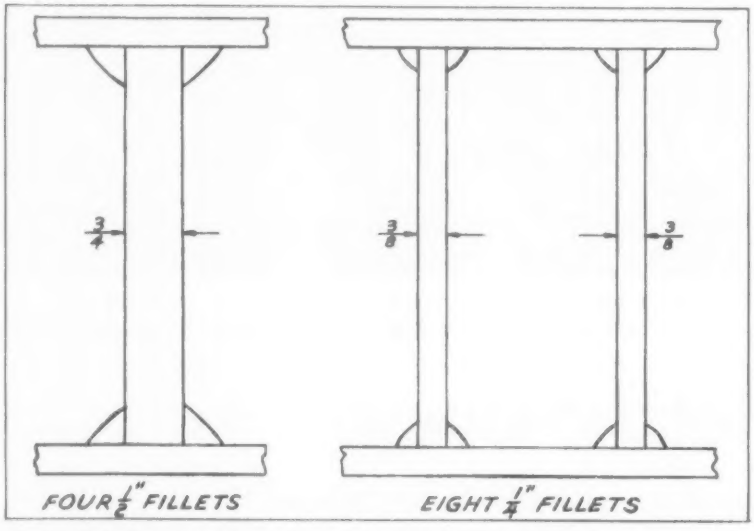
Welds must be engineered to duplicate the strength of the parts at the point of fusion. The weld must be located in an accessible spot, in a position where welding is as easy and fast as possible. Overwelding is to be shunned like the plague, for it can greatly increase welding costs. Exactly the right gaps must be left for fit-up. Arc blow must be avoided, and locked-up stresses and distortion in the weldment minimized.

All of these things are part of the designer's job, thinks Mr. Cleveland. And, indeed, if the designer does not take the responsibility who else can or will?

—The Editors



1—OVERWELDS are costly. See how volume of weld metal goes up with size!



4—EIGHT small fillets cost only about half as much as four large ones

ABOUT 92% of the cost of steel production welding is dependent upon the amount of sound welds produced by the weldors. It is the task of the design engineer to plan the welding of his product. By proper planning, he can eliminate many of the variables that contribute the upper 25% of production welding costs.

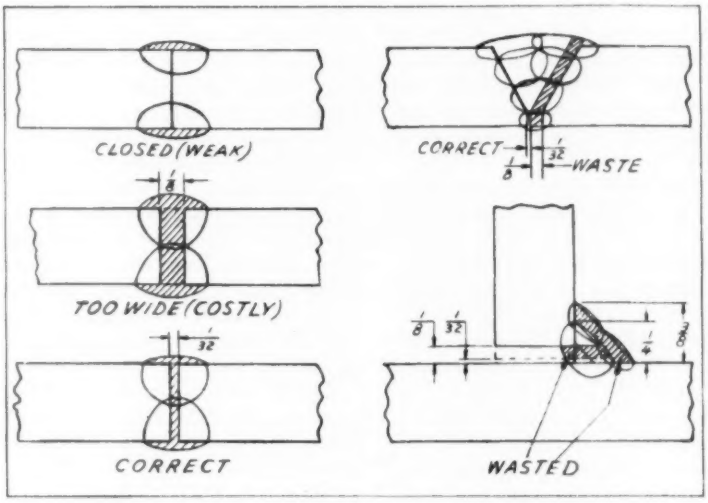
Engineering must control welding! This does not mean that the design engineer is to be given the authority to dictate to the entire plant just how all welding is to be done. It simply means that the welding must be controlled by the specifications on the drawings of the piece-parts and the welded assemblies, via the welding symbols placed upon them.

The most effective method of controlling the costly variables is to tie them down so tightly on the drawings that Production and Inspection have no recourse but to adhere to them. This is done by means of standardized procedure sheets based on accepted correct welding practices.

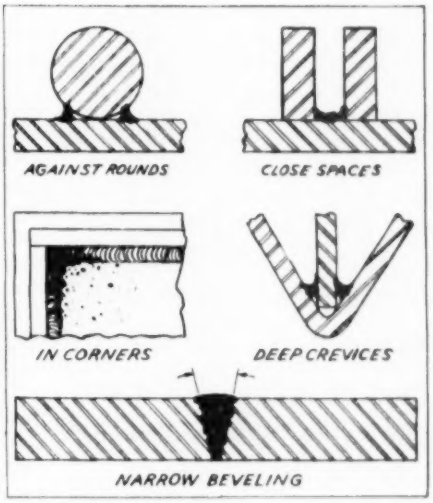
Let's explain this a little further. Say we have a flat-position fillet weld. This is covered, for any plate thickness, by a numbered procedure sheet that lists at the top the proper classification of electrode (in this case E-6012) and sketches the proper method of joint preparation (square-edge, 1/32-in. fit-up gap), together with the symbol used to represent this type of joint on the engineering drawing.

So far so good, but we need more information since plate thicknesses acceptable for this particular type of joint may vary from 3/16 to 1 in. This is taken care of in a very simple manner. If the procedure sheet for the flat-position fillet weld is numbered, say, 5, then we use the numbers 5A, 5B, 5C, 5D, etc., to designate the plate thickness. A table is set up that includes columns for procedure number, plate thickness, gage size (to

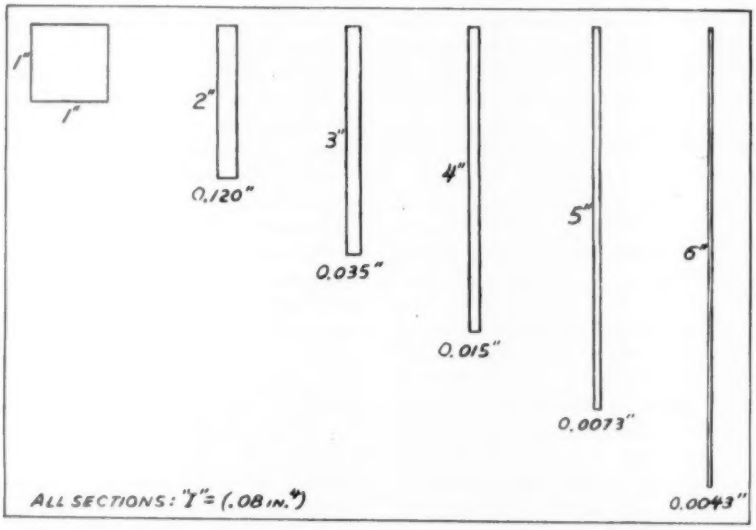
can save you money



2—SELECTION of fit-up gaps should be a designer's responsibility



3—BEWARE of arc-blow conditions above



5—ALL these sections have equal moments of inertia; hence equal rigidity

be later explained), electrode diameter, amperage and polarity, melt-off speed in ipm, welding speed in ipm, number of passes, feet per hour that may be welded at 100% efficiency and lb of rod deposited per foot of weld. All of this valuable information, once compiled, is detailed on a simple table on the procedure sheet.

As an example, let us take row 5A on Procedure Sheet Number 5 for flat-position fillet welds. Running across the various columns, we find that a plate thickness of 3/16 in. (designated 5A) requires a fillet of 5/32-in. gage size, a 3/16-in. electrode and a current of 225-250 amp, a-c. Melt-off rate is 11 ipm and welding speed 13 ipm. The weld is made in one pass. At 100% efficiency, 65 fph are deposited, and 0.105 lb of electrode metal are consumed for every foot of weld. All of this information is conveyed in a highly condensed shorthand merely by placing the number "5A" within the arrow indicating the joint on the engineering drawing.

Without some such system of control, welding costs can mount sky high. Control through Engineering, by the drawings and procedure sheets, holds costs to a minimum and produces weldments of superior quality at the same time.

Cost of Overwelds

One of the principal variables that can be controlled by the use of standardized procedures is the size of fillet welds. The size required to duplicate the cross-section and strength of the plates being welded is always based upon the weakest member. Thickness of this member being known, the size of the fillet required is indicated by the gage size. This is defined as one side of the largest right isosceles triangle that can be inscribed within the weld cross-section. For a plate 3/16 in. thick the gage size is 5/32 in.; for a 1-in. plate it is $\frac{7}{8}$ in. The effective section is the gage size times 0.707.

The great value of a standardized fillet procedure is that it provides a weld of adequate strength without the increased cost of overwelding "just to make sure." Overwelding of fillets is one of the most expensive of welding variables. Figure 1 shows this graphically. Notice that doubling the size of the fillet quadruples the amount of weld metal which must be deposited. If the fillet size is increased by only one-half, the amount of weld metal is more than doubled—count the tri-

TABLE I

(in. of weld per lb of weld metal)

Fillet size, in.	In. per lb
1	7.2
7/8	9.4
3/4	10.3
5/8	18.4
1/2	28.8
7/16	37.6
3/8	51.2
5/16	73.6
1/4	115.2
3/16	204.8
1/8	460.8

TABLE II

(welding costs on AISI steels)

AISI number	Comparative cost
C-1008	$1.10
C-1010	1.10
C-1014	1.05
C-1015	1.00
C-1017	1.00
C-1020	1.00
C-1021	1.05
C-1023	1.10
C-1024	1.10
C-1025	1.10
C-1030	1.15
C-1035	1.15
C-1045	1.15
C-1060	1.20
C-1080	1.20
C-1085	1.20
C-1090	1.25
C-1095	1.25
Too-high sulphur	1.15
Too-low manganese	1.10
Dirty or scaly	1.10
Coated or plated	1.10
Rerolled old rail	1.25

angles in the shaded area for a ¼-in. weld and those in the open area for a ⅜-in. weld in the righthand sketch of Fig. 1! Nothing is added to the strength of the joint by overwelding, for a joint can never be stronger than its weakest member.

Table I gives the number of inches of weld per lb of weld deposit for each standard size of fillet from ⅛ to 1 in. Note that whereas you can get 461 in. (very nearly) per lb with a ⅛-in. fillet, you can only get 7.2 in. per lb with a 1-in. fillet. Use this table as a guide to relative costs.

Another important item the standardized procedures should cover is the proper fit-up gap between parts. Figure 2 shows the effect of fit-up gap or weld strength and cost. If the gap does not exist, the penetration and strength of the weld will suffer. If the gap is too great, the amount of weld metal required to produce the required weld will increase very rapidly, and the cost of the weld along with it.

In butt welds in plates over ⅜ in. thick, special edge preparation is necessary in order to facilitate proper weld penetration. For each such joint, the standardized procedures should prescribe the proper angle or shape of edge required to produce an adequate weld in the most economical manner.

Engineering can thus control both quality and cost of welds with no more than simple symbols. The advantages of this system of control are tremendous, for it removes both quality and cost from the "human element," eliminates guesswork and insures a uniformity of welding unobtainable by other methods. Such a control system requires no special training on the part of the weldor, merely the ability to keep standardized procedure sheets on file and consult them when reading the blueprints.

Can Control Arc Blow

The designer can help avoid a common bugaboo; namely, the effect of excessive arc blow. With d-c welding, arc blow can cause scattered, ugly and weak weld deposits. Arc blow is not experienced with a-c welding. It is the result of the influence of magnetic lines of force upon the arc. These magnetic lines of force are present wherever an electric current is conducted through metal, but they are intensified by the high currents used in arc welding until they become powerful enough to divert the arc.

Arc blow is most intense in deep crevices, in corners, between closely grouped parts and even, to some extent, in T-joints or between the beveled edges of thick butt-welded parts. Some typical arc-blow conditions are shown in Fig. 3. These the designer should beware.

Welds that have been affected by arc blow must usually be rewelded—at nearly double the original cost—in order to obtain a good weld. This also necessitates expensive chipping and cleaning. By avoiding such conditions in the weldment as those shown in Fig. 3, the designer can cut down on welding costs considerably if d-c welders are being used.

Though most welds are designed for strength, some welds are made not for strength but merely to insure rigidity. The distinction is important from a cost standpoint. Weldments designed for strength, with parts and welds placed in tension, shear, or compression, require 100% standardized procedure welds. Welds designed only for rigidity need not be as strong, and in these cases welds of only 50% standardized procedure specifications are required. The designer who takes advantage of this can often save from 25% to 35% of the welding cost.

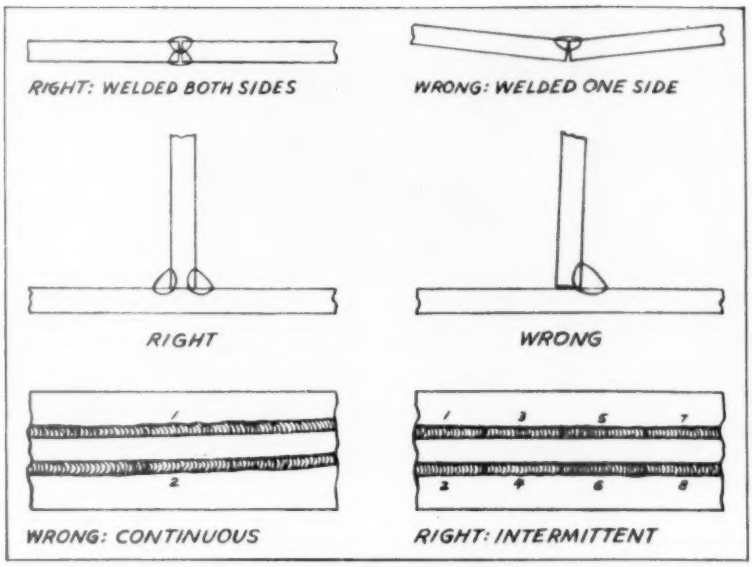
Another method by which the designer can reduce welding cost is to take cognizance of the effect of smaller sections. Width being the same, two members of half section are as strong as one member of full section. But welding costs are not the same. In Fig. 4, the four fillets of the full ¾-in. section require twice the weld metal used in the eight fillets of the two ⅜-in. sections. Thus welding of the two thinner members would be just about half as costly except, of course, for the time required to handle two parts instead of one and to make eight arcs instead of four. Such applications are limited to cases where interior welds may be made.

The expense of welding thick sections increases in proportion to the square of the thickness. Moment of inertia, which is a measure of the ability of the section to resist bending, is much greater for tall thin sections than for short thick sections. In Fig. 5, we see six sections having equal moments of inertia (0.08 in. ^{4}). The thinnest section has a width of 0.0043 in., which is only 1/230th the width of the 1-in. section. Since the metal in a fillet weld increases as the square of the thickness, it would take only 1/52,900th as much weld metal to make a fillet in the thin section. Yet its ability to resist bending is the same as that of the 1 by 1 in. section.

Steel vs. Weld Metal

Mild steel is much less expensive than weld metal. One pound of deposited weld costs the same as 33 lb of C-1020 steel, mill run. Moral: use more steel and less welding.

Utilize thin sections with high "I" or moment of inertia values. Design



6—DESIGNER who specifies procedures can hold distortion to a minimum

with structural or tubular sections, or bend parts to avoid welded joints. Avoid overdesigned thick sections for "safety"; always weld to duplicate the thinest member; utilize every design trick that will decrease the proportion of welding to material or to other fabrication costs.

In addition to the above rules, the designer of a welded product should use the steels that will be most economically weldable. Several major mistakes are commonly made in the selection of steels for welding. For instance, steels in the lowest carbon and manganese range (AISI C-1008 to C-1010) are usually purchased because of their slightly lower cost. This is a grave error because welding costs with these steels are about 10% more than with AISI C-1015, 1017 and 1020 steels (Table II). Reason: the C-1008 and C-1010 steels tend to weld with internal porosity, producing inherently weak joints. To counteract this, welding speeds must be reduced about 10%, increasing costs far out of proportion to the original material cost savings.

Another common error is the choice of free-machining (high sulphur) steels to keep machining costs down. When welding must be done, this is usually a false economy. Steels with sulphur above 0.30% tend to weld with surface holes and to crack on cooling. High-sulphur steels are "hot-short" (tensile strength low when hot) and crack in the weld due to the stresses of cooling. The cost of the cure (reduced current and welding speeds) is greater than the increased cost of machining a steel of better weldability.

Welding costs on commonly used steels of the American Iron and Steel Institute are compared in Table II. The best steels for weldments are known as steels of "preferred analysis," the range from C-1015 through C-1021. The most commonly used is C-1020, with C-1015 running a close second. These are the "mild" steels common to general machine construction and most structural uses. Use them wherever possible to insure good, strong weld joints at the lowest possible cost. Avoid the use of steels of lower or higher analysis wherever better design can accomplish the same result. Moving out of the 1015-1021 range is risky from the welding standpoint and may be very costly.

High-carbon steels tend to produce brittle welds subject to cracking. High-silicon steel (even with low carbon content) cracks upon cooling. High-manganese steel also produces cracked welds, as does low-manganese, high-sulphur steel. A high phosphorous content lowers the surface tension of the molten weld metal and makes the welding difficult to control. Excess phosphorus also produces welds with high brittleness, low shock and fatigue values, etc.

Steels of carbon content in the C-1023 to C-1030 range must be welded at 10% slower speeds, with reduced current and longer arc. This means a 10% or more higher cost. Steels of over C-1030 carbon can be welded successfully only if speeds are reduced by at least 15%, using low-penetration electrodes, decreased current and a much longer arc. In the highest carbon range, low-hydrogen electrodes are a must. Welds made with these electrodes by proper procedures should not crack, but the welding will cost about 25% more than welds by standard procedure on steels of the preferred analysis. Also it is sometimes necessary to preheat such joints to prevent cracking, raising the cost still more. The designer who wants to save money will stick to mild steel.

Even though a high-carbon steel can be welded successfully by such methods as making successive passes, with preheat and postheat for each pass), the greater welding cost will pay for a far heavier section of mild steel—or for much more design time spent in trying to avoid the use of high-carbon steel.

Welding on steels of the preferred analysis is faster, less expensive and much better. There are no restrictions on type of joint, type of electrode, amount of current or welding speed. Larger electrodes and higher machine settings can be used to obtain deeper penetration and produce stronger welds at lower cost.

Shrinkage a Design Problem

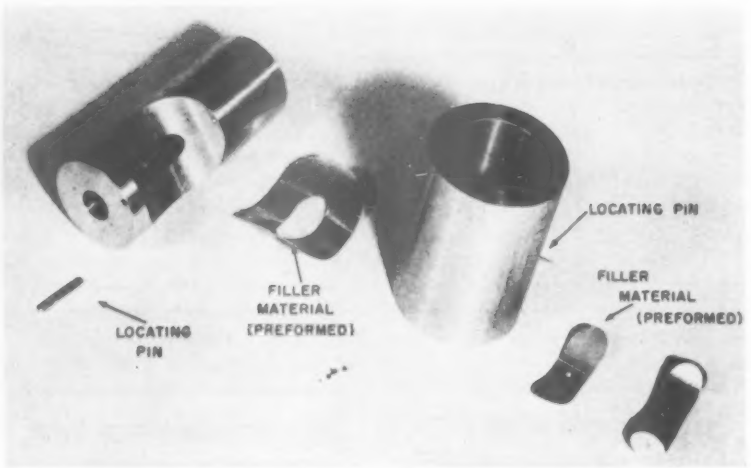
Proper weldment design can also circumvent the necessity for correcting the distortions caused by shrinkage of the welds upon cooling. The shrinkage of the weld metal can be made to work against itself. The designer can also help by planning his designs in such a manner that much of this distortion is prevented. Figure 6 shows several right and wrong ways of controlling distortion.

It actually costs less to duplicate the cross-section of a welded member by making passes on opposite sides than to weld with only one pass on one side. This is shown in Fig. 6, along with an illustration of intermittent versus continuous welding of butt joints. Both are samples of "balanced" welding, which is the true secret of preventing distortion.

There are no visible limits to cost reduction in weldment design. The rule is simply this: Do everything possible in the planning stage and so prevent the useless expenditure of costly welding labor. It is properly the designer's job, and he should be given a free hand.

1. CLEANING

Parts, loosely wired together, are precleaned by dipping in solution of hydrofluoric and nitric acids



2. ASSEMBLY

Preformed shims of brazing alloy are preplaced during assembly. The locating pins save on the cost of fixtures. Two shims will braze the above four parts in one operation (see photo 4). DOFL uses 718 aluminum brazing alloy, forms it into shims for lap and butt joints

Five steps for

BY THOMAS F. PROTZ
Chief of Shop Services, Guided Missiles, Diamond Ordnance Fuze Laboratories

As told to Herman C. Phelps

THE PROCESS is practical, and many fabricators of aluminum may solve production problems of intricate, as well as simple, aluminum parts by following thoroughly the technique described in this article.

The equipment is economical, and its cost can be more than offset by savings in time, product appearance and lessened rejects.

The Editors

DID YOU know that intricate aluminum parts can be successfully brazed by dipping them into molten salt (aluminum flux)? Where neither welding nor riveting is feasible, this has proved to be a fast and easy method of making perfect joints. The assemblies can be of different sizes, shapes and joining areas.

Dip brazing is not a hit-and-miss affair. At the Diamond Ordnance Fuze Laboratories in Washington, D. C. (a class II field installation of the U. S. Army), research and development on this and other processes are carried on by a staff of engineers, physicists and technicians.

Such alloys as 2S (new designation AA 1100), 3S (new designation AA 3003) and 61S (AA 6061) all have excellent brazing qualities and lend themselves very well to molten dip brazing. So does casting alloy 195.

Diamond Ordnance Fuze Laboratories (hereafter called DOFL) divides the dip-brazing process into five basic steps. They are:

1. Precleaning
2. Assembly
3. Preheating
4. Brazing
5. Flux removal

1. Precleaning

Precleaning is fast and easy. Usually, it is done by giving all parts a degreasing in a trichlorethylene vapor. Occasionally, a caustic etch is used but not always. After the trichlorethylene treatment, the parts, including filler metal, are submerged in a solution of one part hydrofluoric acid, one part nitric acid and 98 parts of water. The period of submersion is around two or three minutes; the exact time sometimes has to be determined by experiment. A good rule DOFL follows is to keep the parts submerged until the solution shows etching activity on all surfaces. This requires caution because a smooth surface after dipping is a must, and etching from too long an immersion will make the surface rough. A rough surface does not allow the filler metal to flow freely and evenly.

After cleaning, the parts are rinsed in hot water (180 F-200 F) and dried quickly to prevent water spots.

2. Assembly

Care must be exercised in handling the parts during assembly. The areas that are to be brazed must *not* be touched by human hands. When preformed filler metal is to be preplaced, it is picked up and inserted into the brazing area by tweezers.

The amount of filler metal required is usually determined by experiment. Some joints require a larger fillet, deeper penetration, etc., than others.

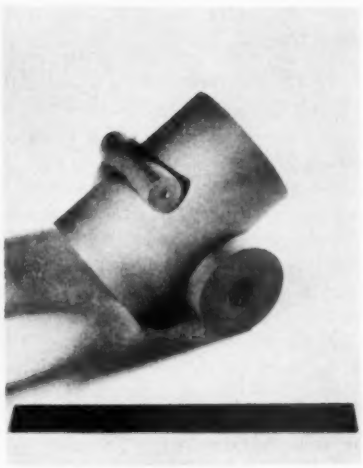
The laboratory uses 718 aluminum brazing alloy for filler metal and forms it into shims 0.002 in. to 0.003 in. thick for lap and butt joints. As received, the brazing alloy is in wire and strip form; it is rolled into the desired thickness, formed and cut to size. Blanking and forming dies are used to produce large quantities of the various shapes—rings, channels, etc.—needed for some assemblies.

3. PREHEAT

Assembled components go into an electric furnace, where they are preheated to between 950-1,000 F

4. DIPPING

Assembly is lowered into molten flux. Brazing is done at closely controlled temperature of 1,120 F



5. FLUX REMOVAL

Finished part after postcleaning. Water-soluble flux is washed off by immersion in agitated hot water

molten dip brazing

DOFL also uses brazing sheet, an aluminum stock clad with 718 brazing alloy. This is available in virtually any thickness and is used to good advantage in sandwich assemblies.

DOFL designs the parts for a dip-brazed assembly so that they are self-jigging or self-aligning. Pins, steps, flanges, counterborings, etc. are carefully designed to eliminate the need for elaborate jigs and fixtures. Their ideal design is to hold all parts locked together at assembly by means of a single spring. Frequently, sheet-metal parts (made of 1/32 in. or ⅛ in. stock) are spot welded after filler metal shims have been inserted to hold them together for brazing.

3. Preheating

The assembled parts, with filler shims inserted properly and clamps and springs also in place, are dipped as a unit into the hydrofluoric-nitric acid solution for a period of from one to two minutes. The assembly is then rinsed in hot water and placed in an electric furnace, where it is brought up to a temperature of 1,000 F.

The time cycle depends on the amount of mass in the assembly. Preheating must be carried on long enough to remove all moisture from the parts before the assembly is dipped into the molten flux. The preheat also enormously speeds up the brazing operation because the salt bath is not required to raise the temperature of the assembly more than 70 to 120 F.

Parts are preheated only long enough to assure a uniform heating. If the parts remain in the preheat furnace too long, say three or four hours, oxidation of the aluminum surface takes place, and the brazing alloy will not flow uniformly.

4. Brazing

The dip bath is a ceramic pot 9 by 13 by 36 in. deep. It contains 300 lb of granulated aluminum brazing flux, held in the molten state (1,120 F ± 5 F) by submerged Monel electrodes.

The actual brazing operation is one of the simplest steps. Immediately upon removal of an assembly from the preheat furnace, it is submerged in the flux bath. Normally, 15 to 30 seconds is long enough though additional time may be required for brazing if the parts contain an appreciable mass.

The operators watch the brazing operation by eye. Visibility while the assembly is submerged in the molten salt is excellent. When the capillary flow of the preformed alloy has been completed, the fillets are evenly formed and perfect in every detail.

Doing It by Hand

Hand application of the filler metal is a variation on the technique of the dip brazing process. The steps are the same except that the filler-metal shims are not inserted during assembly. After the parts have been submerged in the flux bath, the joints are wiped with rods of 718 aluminum brazing alloy, 1/32 to ⅛ in. in diameter. The operators develop a technique in a relatively short time.

Actually what happens is this: The filler rod being at room temperature, there is naturally a time lag before the rod temperature can be raised to the melting point by the bath. The delay is long enough to allow the operator to reach the brazing area with the tip of the rod. Because the flux bath is maintained at 1,120 F, the wiping action is accomplished while the rod is in a plastic state. As the temperature rises, the filler rod is drawn into and around the joint by capillary action. An extremely neat and uniform joint is achieved.

Once the technique of hand application has been developed by an operator, the assembly process is speeded up. No preplaced filler shims are required, and fixtures do not need to be so elaborate. Furthermore, it is

easy to fill voids with additional metal.

5. Flux removal

The brazed assembly is removed from the bath and is either tilted or rotated to allow the excess flux to drain. However, the flux freezes on within a few seconds after the assembly has been removed from the bath. Fortunately the flux is water soluble and may readily be washed out of cavities by agitated hot water.

Quenching in water sometimes follows immediately after flux draining if distortion is not a factor. However DOFL allows most assemblies to cool to room temperature before they are submerged in agitated hot water. Aluminum brazing flux is highly corrosive and must be entirely removed. To improve the appearance, a mild caustic etch and an aluminum bright dip are used. The caustic and acid dip, however, will not remove the flux, which must be entirely washed away by the hot water.

To stop brazing metal from forming a fillet in an undesirable position, the operators anodize all parts (when permissible) and then machine only the areas where brazing is to be done. The anodized surfaces will act as a buffer to keep away excess alloy.

Care of Flux Bath

The flux bath operates 24 hours a day, seven days a week. Its temperature is controlled by an indicating pyrometer, the thermocouple of which is submerged to a depth of 18 in. Care must always be exercised to keep the bath from being contaminated by iron or copper. For this reason, all holding devices used in the bath are of pure nickel, Inconel, Monel or stainless steel. DOFL never allows any part to be placed in the bath that may contain free iron or copper. Steel or brass screws will also result in severe contamination of aluminum parts.

Stainless steel is the most economical material for jigs and fixtures but it is also the material most likely to cause contamination. On short runs, this problem is not too critical as the flux level of the bath must be replenished frequently to replace the carry-off when parts are removed. When production loads are put through the bath and the flux level is brought back to normal after a period of one week, nickel fixtures are more satisfactory from a contamination standpoint.

Two related factors should be considered when designing a part for aluminum dip brazing. In most instances, the finished part contains one or more components that require some machining. 61S aluminum in T4 or T6 temper offers excellent machinability without sacrifice of brazing qualities.

After brazing at a temperature of 1,120 F, all aluminum alloys are in the annealed condition when removed from the bath. However, 61S is a heat-treatable alloy and can be brought back to a T4 or T6 temper without harmful effect to the brazed joints.

The temper heat-treat and quenching cycle usually follows immediately after removing the brazed assembly from the flux bath. A good technique is to allow the flux to solidify or freeze on the part, which occurs when the assembly is close to 980 F. The part is then quenched in cold water.

Stitch welding in Britain

BY WALTER SEKULES

New "stitch welding" system developed in England enables welding speeds as high as 300 welds per minute. This compares with British speeds of 180 for the motor-driven machine and 120-150 welds per minute for the customary air-operated spot welder. Introduced recently by New Process Welders Limited, London, England, the new welding system insures full control of the weld cycle in spite of the high speeds attained.

With air-operated stitch (spot) welders, the friction in cylinders is apt to cause variations in the time cycles and irregular operation of pressure switches. Moreover, the different electropneumatic devices in the system—single-solenoid magnetic valves, for instance—are not constant in speed of operation to the extent needed.

The new machine provides two movements: a relatively long stroke for retraction over the obstructions in the work or fixture and a very short stroke for the actual stitching.

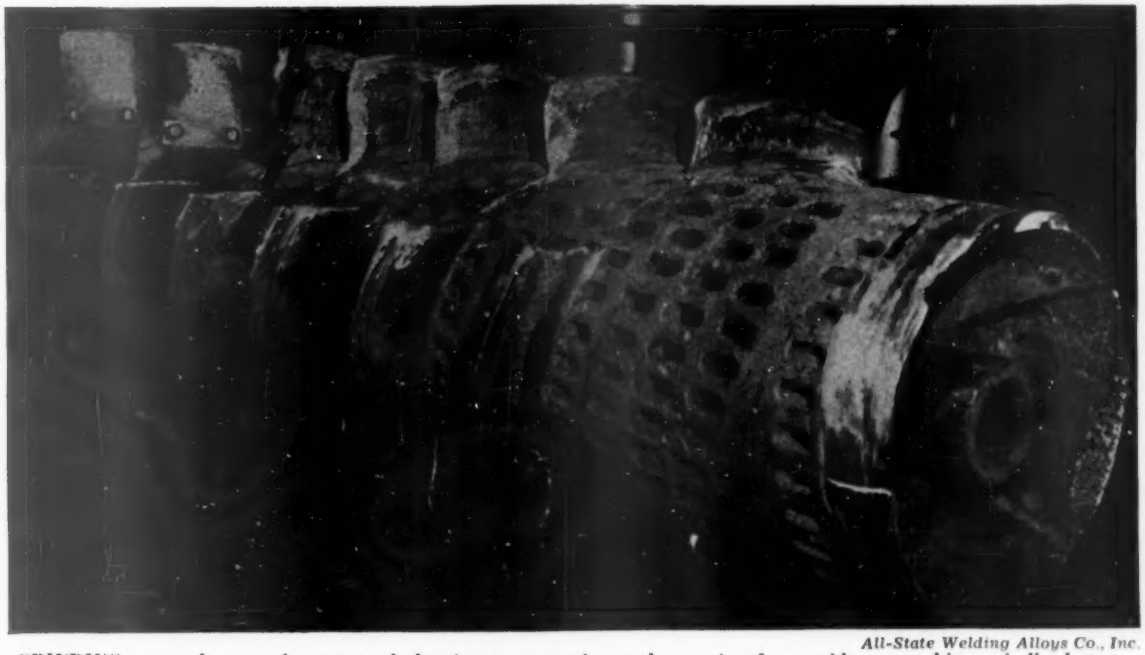
An orthodox piston-type cylinder is used for the long stroke. It is controlled by an orthodox magnetic valve and foot switch. Attached to its piston, however, is a diaphragm cylinder with a stroke of ⅜ in. or less. This double-operating diaphragm cylinder is supplied by a special magnetic valve, with two solenoids, which is capable of operating at the necessary high speeds.

The magnetic valve and current initiation can be controlled by cam switches operated by a synchronous motor. But it is, of course, better to control the whole system electronically, and a special panel has been developed for this. Two dials control the operation of the magnetic valve, and they make it possible to vary, in any required proportion, the times during which the electrode is up or down. A third dial controls the delay between pressure application and the closing of the weld circuit. A fourth dial is provided for timing the weld within the pressure period.

Electronically controlled times are transmitted accurately to the work, and constant welding conditions are assured because the diaphragm cylinder is friction-free. Employment of an ignitron-type contactor is essential in view of the high speeds involved and the need for accurate cut-off of current.

Another important application of the English stitch welder is the welding of alloys with a short plastic range such as nickel-chromium and aluminum alloys. In England, the customary air-operated spot welder is unsatisfactory for this application. As material reaches welding temperature, collapse takes place; and if forging pressure is to be applied, the electrode must be capable of following up immediately and maintaining constant pressure on the surface of the work.

To overcome the handicap of the air-operated spot welder, English engineers frequently interpose a spring. Its compression, however, cannot be accurately determined, and it is liable to deterioration through wear and tear. On the new equipment, the diaphragm cylinder is friction-free and can be used as a cushioning device for spot welding the short-plastic-range alloys. It is possible to determine and record the exact pressure that is applied to and maintained on the work.



All-State Welding Alloys Co., Inc.

GRINDING up sandy sugar beets caused abrasive wear, erosion and corrosion from acids on crushing spindle, but . . .

Problem was licked by surfacing

BY H. S. PATTERSON AND VAN LOTT*

BECAUSE of several kinds of wear, crushing spindles were a constant headache to us at the Toppenish, Wash., plant of the Utah & Idaho Sugar Co. The blades had to be continually built up with manganese bronze, deposited by gas welding. An average spindle would last about two years before rebuilding.

We have recently switched from manganese bronze to a 10% nickel-silver brazing rod, deposited by gas welding as before. A trial spindle built up with this rod showed so little wear after two years' service that we put the change into effect as a regular procedure.

Today the crushing spindle problem has been reduced to such an extent that the machines have to be dismantled only half as often or perhaps even less than that. And dismantling such equipment in order to remove the spindles is a long and costly operation.

Flame on the Rod

We don't need too much preparation to do a build-up job. No preheat was required. Usually, the edges of the fins are already clean from the abrasive wear of the sand in the sugar beets, so it is only necessary to apply paste flux over the worn area.

One thing we found out early: don't overheat the cast-iron blade or you will stop the metal from flowing. To avoid overheat, keep the torch flame on the rod, not on the parent metal. With the flame on the nickel-silver rod and the torch held at a 45-deg angle, the flame will push the metal ahead; scratching with the rod is not necessary.

Because the flame is on the brazing rod, at no time does any more than a slight color show in the cast iron. Where more than one layer of metal is necessary, we paint the brazing rod with the paste flux. Dipping the hot end of the rod into the flux is not satisfactory.

Because of the size of the cast-iron spindle, a large amount of metal is required for reclamation. Hence the selection of an economical rod is imperative. The nickel-silver rod on a pound-for-pound basis costs more than the manganese-bronze rod, but it saves money, nevertheless.

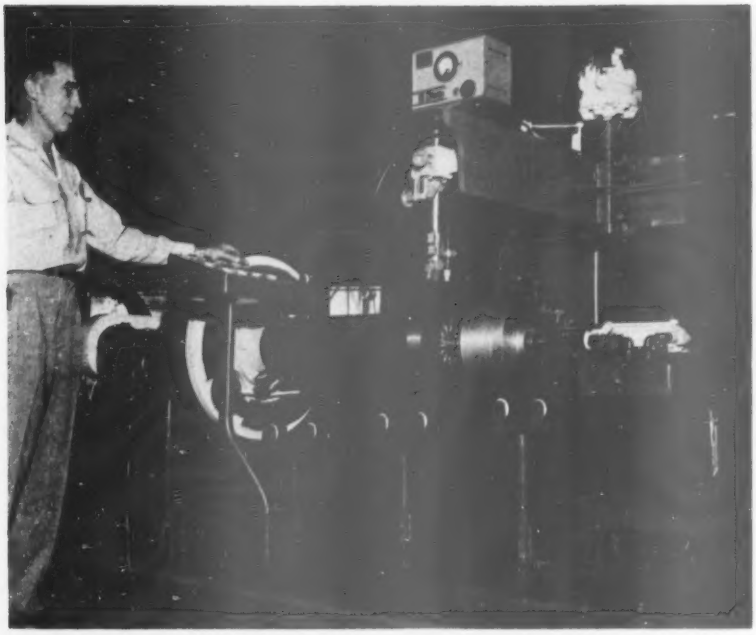
A cost comparison shows:

Two reclamations by manganese-bronze rod:	
200 lb of ¼-in. rod	$138.26
80 man-hours	200.00
10 cylinders of oxygen, 8 cylinders acetylene	101.00
Total	$439.26
One reclamation by nickel-silver rod:	
100 lb of ¼-in. rod	$162.00
40 man-hours	100.00
5 cylinders of oxygen, 4 cylinders of acetylene	50.50
Total	$312.50
Saving per spindle	$126.76

Over a four-year period, these figures show an annual saving of $31.69 per spindle per year.

From a dismantled plant, we acquired for our Moses Lake plant eight excessively worn spindles. It required a total 1,671 lb of ¼-in. rod to rebuild them. Our own preventive maintenance program would never allow such conditions to occur.

*Mr. Patterson is chief master mechanic, Toppenish and Moses Lake (Wash.) plants of Utah & Idaho Sugar Co., and Mr. Lott is master mechanic at the Toppenish plant.



UNLOADED Cone welder is in an operating position but without the cone segments in place. The nose positioner has swung forward with positioner ram extended; tungsten inert-gas welding head is in position for welding. All controls are in box at top left

New welder for cones

LOADED Cone welder at work. Gravity rolls help feed the cone segment onto the expanding mandrel and aid just as much during unloading. Both the welding head and the stand holding the pneumatic nose positioner may be swung out of the way to provide clearance for loading and unloading

BY GILBERT C. CLOSE

ALL the good features of past circumferential welders brought together and incorporated in a single machine. . . .

This is a fitting description of the cone welding machine designed and built recently by Airline Welding and Engineering Co., Hawthorne, Calif.

When pressed for details, Bryon R. Russell, owner-manager of Airline Welding and Engineering Co., admitted that his new machine incorporates several refinements not hitherto found on any similar welder. The initial model has been purchased by a major aircraft parts manufacturer.

The machine can be easily tooled for the circumferential welding of cones or tubular structures of any practical size by merely changing the expanding mandrel and nose positioner. The mandrel holds the open end of the cone and the nose positioner the apex or nose section.

Welding is done by the Tig (tungsten inert-gas) process, with automatic feed of the filler wire. The welding head is adjustable, both vertically and transversely, throughout the range of the machine and swings out of the way while the machine is being loaded.

Gravity rolls are located just below the expanding mandrel. These assist loading of the open-ended cone section onto the mandrel and the unloading of the finished cone from the mandrel. To further expedite loading and unloading, the stand holding the pneumatically operated nose positioner may be swung backwards out of the way.

The segmented expansion mandrel at the rear is hydraulically operated; when under pressure, it centers the rear portion of the cone around the mandrel. The forward segmented expansion mandrel is likewise hydraulically actuated and serves as the back-up bar for welding. When this mandrel is fully expanded, the gaps between segments do not exceed 0.001 in. so no fall-through of weld metal occurs.

The cup-shaped nose positioner, when penumatic pressure is applied, moves toward the left (see pictures) to hold the nose of the cone firmly against its mating component.

All mechanical and welding controls are contained in a single panel adjacent to the operator's normal working position.

Here's how to end porous welds

Cause	Remedy
Excessive moisture in the electrode coating	Use electrodes with dry coatings. Electrodes with wet coatings should be baked for about two hours at 300 F.
Improper coating formulation	Return electrodes to supplier or else scrap them
Moisture on joint area	Dry joint area prior to welding
Grease, oil or paint in joint area	Clean off prior to welding
Free-machining steel (sulphur- or selenium-bearing)	Weld this material with low-hydrogen electrodes—properly dry
Aluminum-killed steel	Dry low-hydrogen electrodes
Cracked coating on electrode	Scrap electrode
Improper welding procedures	Use low arc voltage, high current (within range recommended by manufacturer), reduced welding speed or weaving
Cold start	Strike arc slightly ahead of the intended start. When arc is stabilized, bring it back to desired starting point before resuming forward movement
Excessive rate of solidification	Maintain a molten weld pool for a longer time by increased heat input from (*a*) higher current, (*b*) slower welding speed or (*c*) preheating
Incomplete penetration	Use higher current or slower speed
Porosity of excessive segregations in the steel to be welded	Chip out or gouge out slag and porous areas
Slag and sand pockets in castings	Chip or gouge out prior to welding

BY HELMUT THIELSCH
Metallurgical Engineer, Grinnell Co., Providence, R. I.

POROSITY in weld metal is so well known a condition that it needs no description. It is due to the entrapment of gases within the weld metal. Such gases may originate either by the breakdown of gas-forming components in the electrode coating or by the dissociation of moisture absorbed by the coating.

The arc-produced gases dissolve in the molten weld metal, but the ability of the metal to hold gases in true solution grows less as the molten metal cools. Consequently, the dissolved gases are liberated and may collect in the form of bubbles. Gas bubbles may also be created by chemical reactions that occur in the molten weld pool.

The bubbles, being lighter than the molten metal, tend to rise to the surface. Sometimes they succeed in reaching the surface of the pool before solidification is completed, and sometimes they fail. If they fail, they will be entrapped inside the weld metal as *internal porosity*. If they reach the surface, they may appear as *external* or *surface porosity*. The radiograph of photo 1 illustrates internal porosity in a deposit made with an improperly balanced commercial electrode. Photo 2 shows surface porosity in a deposit on sulphur-bearing free-machining steel.

Porosity may be dispersed at random throughout the whole weld. Likewise its distribution may be confined to the root or to the surface of the weld, or be isolated in small local clusters.

Assuming that there are no foreign materials in the weld zone, the occurrence of porosity depends primarily upon: (1) the composition of the steel (base metal); (2) the chemistry of the electrode coating, and (3) the welding procedure. We'll look at each cause in turn.

1. Steel composition

Welds on free-machining sulphur-bearing or selenium-bearing steels tend to be porous when relatively large quantities of hydrogen are present in the arc atmosphere. The reasons for this are not yet completely understood. Some authorities feel that the sulphur or selenium in the steel reacts with the hydrogen and forms hydrogen sulphide (H_2S) or hydrogen selenide (H_2Se) gas bubbles. Other investigators believe that the important reaction is between iron oxide and iron sulphide, which reaction at high temperatures tends to form SO_2 gas bubbles. Whichever the case, the resulting gas bubbles are generally entrapped in the molten weld metal.

Low-hydrogen electrodes (provided that they are dry), prevent porosity in sulphur- and selenium-bearing steels.

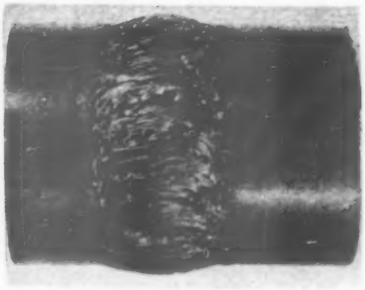
Other reactions sometimes responsible for porosity are the production of carbon monoxide (CO), from the reaction of iron oxide with carbon, and of methane (CH_4), from the reaction between carbon and hydrogen. Welds made with today's arc-welding electrodes, however, are unlikely to experience these reactions in significant quantities unless improper welding procedures are employed or the base steel contains a large amount of oxide inclusions.

Welding of aluminum-killed steels with electrodes having cellulose-type coatings (E-XX10 or E-XX11) may also result in weld-metal porosity, particularly when slow welding speeds and low amperages are used. With steels where this is critical, dry low-hydrogen electrodes (E-XX15 and E-XX16) should be used.

2. Coating formulation

Proper formulation of the electrode coating by the manufacturer is extremely important. Although the very

1—INTERNAL porosity; deposit made with improperly balanced electrode



2—EXTERNAL or surface porosity

large majority of coated electrodes marketed today are fully satisfactory, an occasional "off" lot is shipped with an improperly formulated coating. New electrode types, prematurely marketed before coatings have been sufficiently developed and tested, may deposit weld metal containing excessive porosity. The radiograph of photo 1 was taken of a test weld made from a new commercial electrode of the low-hydrogen type containing small percentages of chromium and molybdenum.

Even though an "off-formulation" is a rare exception, the responsible fabricator of pressure piping and pressure vessels will carefully test and evaluate every lot of electrodes before approving it for shop fabrication or field erection.

Electrodes that were perfect when shipped may be ruined for welding by improper storage. Particularly is this true of low-hydrogen electrodes, which must always be kept dry.

Electrodes that have been shipped in moisture-proof containers and then kept dry by storage in rooms or cabinets heated to about 20 F above room temperature will rarely produce porous welds. Unless, of course, other factors such as paint or oil on the steel surface intervene to provide a supply of hydrogen.

Upon removal of the electrodes from the storeroom, further moisture control is accomplished by holding them at a temperature of 250-300 F in an electrically heated drying oven at the welding location. The weldor removes only a few pounds at a time for insertion into his portable electrode container. If he uses them while they still retain sufficient heat above room temperature, they will not be adversely affected by the possible presence of moisture in the atmosphere. Proper use of electrode drying oven and portable electrode container is illustrated in photo 3.

Moisture in Coatings

Electrode coatings can absorb moisture from a humid atmosphere as well as from actual immersion in water. The amount of moisture absorbed from the atmosphere depends primarily upon the relative humidity and the length of exposure. Moreover, the degree of moisture pick-up varies from one coating to the next. In some coatings the moisture pick-up is greater from exposure in a humid atmosphere than it is from immersion in water.

Whenever moisture is present in the coating of an electrode or on the surface of the base metal, it will be dissociated in the welding arc into free hydrogen and oxygen. The chemical reaction takes place at about 2,370 to 2,730 F and is generally described by the so-called water-gas reaction:

$$CO + H_2O \leftrightarrows CO_2 + H_2$$

Although the relative amounts of the evolved gases depend upon the type of coating, the total quantity of carbon monoxide and hydrogen generated is rarely less than 75% of the total gases formed.

The effect of moisture in the electrode coating will vary with the type of coating. Coating types are classified as cellulosic (E-XX10 or E-XX11), titania (E-XX12 or E-XX13) iron-oxide (E-XX20 or E-XX30) and lime-ferrite (E-XX15 or E-XX16).

Electrodes with cellulose type of coatings usually benefit from a moderate moisture content. The dissociation of a certain amount of water vapor in the flux crucible of the electrode is held desirable, in that it controls the decomposition of the organic compounds. Excessive drying of E-XX10 or E-XX11 electrodes, say by baking at temperatures above 600 F, may unbalance the chemistry of the coating formulation, perhaps sufficiently to cause severe porosity. Cellulosic electrodes are highly recommended where welding must be made in a humid atmosphere or under water. The explanation generally accepted for their behavior is that in them a slight amount of moisture does not seem to increase the partial pressure of hydrogen. Beyond a certain limit, however, moisture may again become detrimental, so it is desirable that the cellulosic electrodes be used in dry condition. If they have become excessively wet, they may be dried at about 300 F.

In low-hydrogen electrodes with lime-ferritic coatings, an increase in the moisture content raises the partial pressure of hydrogen, which in turn increases the formation of porosity. These electrodes are most critically affected by moisture.

Iron-oxide type of coatings are adversely affected by moisture, which is dissociated into hydrogen in the arc flame. Some of the hydrogen is absorbed by the molten weld metal, where it reacts with iron-oxide in the following manner:

$$FeO + 2H \leftrightarrows Fe + H_2O$$

This reaction will continue until either the available oxygen or the available hydrogen in the weld metal has been used up. The water vapor, which forms and is trapped within the molten weld metal, results in internal and surface porosity.

A common redrying schedule is two-hour drying at 300 F.* Where

*Electrodes exposed to humid environments take on moisture by chemical combination in addition to absorption. To remove the combined water, drying for two hours may be required at temperatures as high as 900 F. There are many commercial electrodes that may be dried at this high temperature without sacrificing usability characteristics or causing the coatings to become fragile. Ordinarily such a high temperature is not necessary. Only when certain critical, highly hardenable steels are welded under unusual conditions, at high restraint or at subfreezing temperatures, may such high-temperature drying be required.

3—PROPER use of electrode drying oven and portable electrode container

drying ovens are not available, coatings on mild-steel electrodes can sometimes be dried by shorting out the arc at standard current settings. Shorting is kept until steam is no longer being given off by the electrode coating. This method should be used with considerable care and should not be used to dry alloy-steel electrodes.

To sum it all up, electrodes that have been allowed to become moist should be dried, and particularly low-hydrogen electrodes.

All electrodes are not reclaimable. If the coating has flaked off as the result of excessive moisture or the drying operation, the electrode should be scrapped.

3. Welding procedures

The heat input into the weld may have a considerable effect upon the weld-metal porosity. Welding current, voltage, travel speed, arc length and welding sequence all influence the heat input and so may be responsible for the formation of porosity.

Current and voltage values outside the ranges recommended by the electrode manufacturer may result in porosity. Ordinarily, high welding currents minimize formation of porosity, although they may produce other undesirable effects. The sulphur-bearing steels are an exception to this rule; with them, more porosity is formed at higher current and retained in the weld metal.

Increases in the rate of electrode travel reduce heat input into the weld. This results in a higher rate of solidification and allows less time for gases to escape. At too fast a travel speed, gases may become entrapped in the weld metal during the rapid solidification. A slower rate of electrode travel introduces more heat in the weld and reduces the rate of cooling. Slower cooling allows a longer time for the gases to escape, which minimizes porosity. Weaving also introduces more heat in the weld; hence helps to slow cooling rate and keep down porosity.

Starting the arc on cold steel may promote porosity. Gases are entrapped in the initial part of the weld bead, which solidifies rapidly because of the quenching effect of the cold base steel. To minimize this quenching effect, strike the arc ahead of the intended start and bring it back to the desired starting point after it is stabilized. Forward movement is again commenced in the regular manner.

Surface Conditions

The welding procedure may be extended to cover all the preweld operations, especially cleaning. Dirty metal is apt to have porous welds.

Grease, oil or paint on the surface being welded are sources of hydrogen. Rust or scale acts as a source of oxygen. During welding, free oxygen may react with hydrogen to form water vapor or with carbon to form carbon monoxide, either of which can cause porosity.

Slag and sand pockets on castings are another trouble source. To avoid porosity, they should be chipped out or gouged out to provide a clean surface for welding.

Don't reweld over a porous area. Welding on a porous base (in this case the weld metal) tends to introduce porosity into the weld bead. The porous areas should be removed by grinding, chipping or flame-gouging or arc-cutting before rewelding is done.

Sometimes weld-metal spatter may be porous, particularly when it is deposited from a cellulosic electrode. If welding is done over the spatter, porous weld deposits may result.

Effects of Porosity

Porosity lowers tensile and fatigue strength. The fracture surfaces of tensile and fatigue specimens will often show "fisheyes" that contain areas of porosity in their centers.

Impact is unlikely to be affected by porosity, unless it is very severe.

If the recommendations of the electrode manufacturers are followed and if the welding operation is properly supervised, the amount of porosity observed in most welds is likely to be negligible and within the amount tolerated under most inspection codes.

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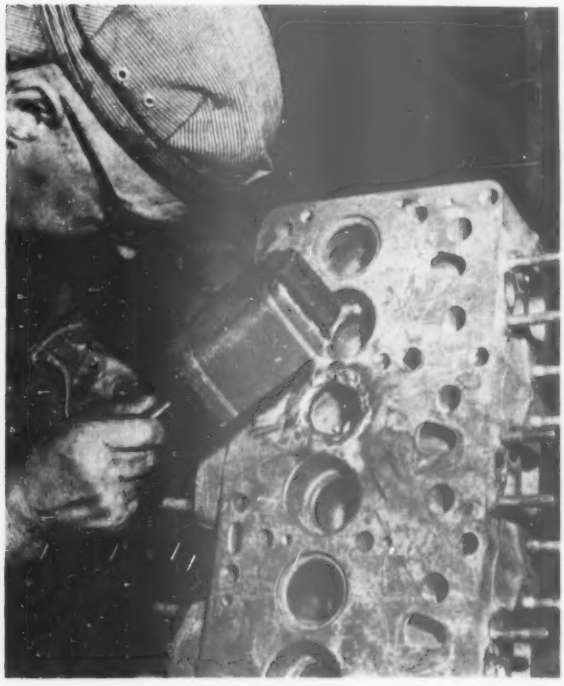
"That's gratitude. Get him a junior welding outfit and he takes business away from his own father."

1 Wayne Tromble has chalk marked a crack in a cylinder block dangerously close to cylinder liner

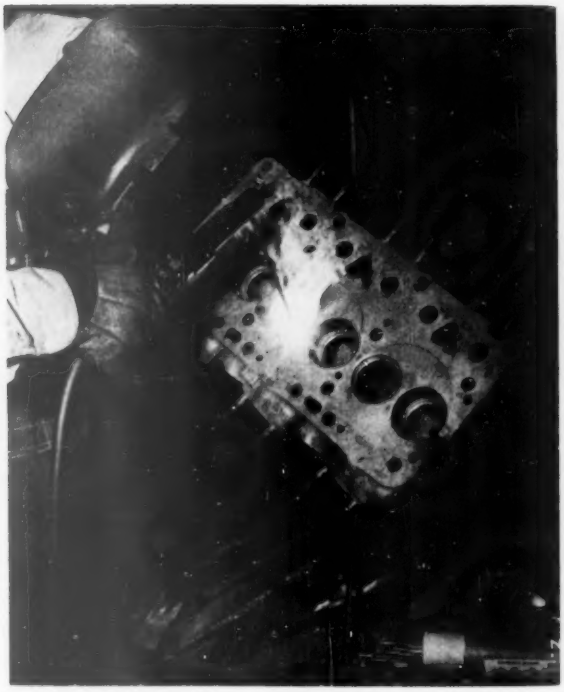
2 Another job: Frank Zeitler wire brushes a valve seat on cylinder head preparatory to rebuilding

Buffalo buses kept running

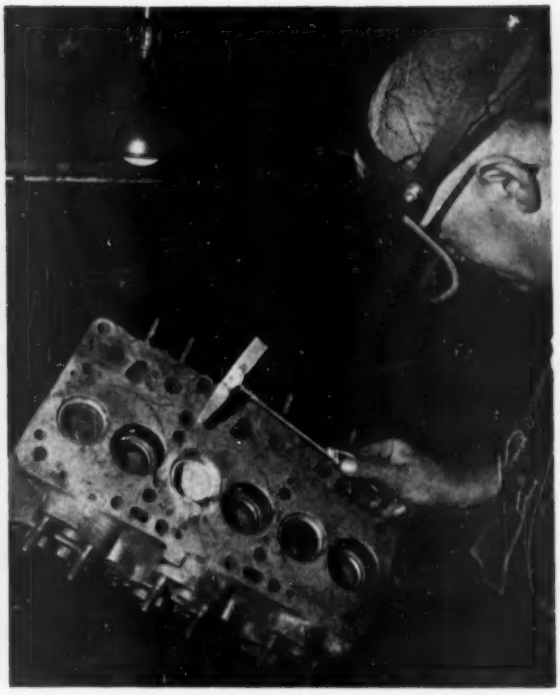


5 Inspecting rebuilt valve seat. Case in Zeitler's hand contains a magnifying glass and a light bulb

6 Wayne Tromble points out repair in cracked block. The welding was done with a 55% nickel electrode



3 Matthew Schuman lays first bead. Seat of bus engine cylinder block is built up with pure nickel



4 Frank Zeitler returns to chip away the slag after Weldor Schuman has laid first layer in valve seat

KEEPING 720 buses in running order is a major maintenance operation at Niagara Frontier Transportation System, Inc., Buffalo. In a year, the welding department builds up the valve seats in 75 to 100 blocks, repairs an equivalent number of blocks because of cracks or other damage. "Other damage" covers such contingencies as a connecting rod breaking and ramming through the side of a casting (cause of repair in photo 6).

On valve seats, where 100% machinability is required, a ⅛-in. 99% nickel electrode is used. To repair cracks in cylinder walls, jackets, etc., a 55% nickel electrode is used.

EIGHT DONE AT ONCE

Since eight to ten reserve cylinder blocks and heads are kept on hand, the welding department does not need to repair the blocks as fast as they come in for servicing. Damaged or worn castings are saved up until there are eight to repair. All valve seats are then ground and wire brushed at the same time. Cracks are veed by chipping and wire brushed on a several-at-time basis.

Suitably prepared, the eight castings are oven preheated for half an hour at 900 F. This burns out all impregnated oil and foreign matter. After the oven is turned off, the castings are allowed to cool down slowly to about 400 F before removal.

From the furnace, the castings are removed one at a time and placed in a rotating positioner. On valve seats, all beads are deposited downhand. Only a short bead, ¾ to 1 in. long, is run; then it is cleaned and peened. One, two or three passes may be made, depending upon the depth of the layer. After each pass, the weld area is peened with a round-nose tool and wire brushed. They do not like a ball hammer for peening.

Cracks or breaks in the cylinder heads or blocks are repaired with nickel-iron electrodes (55% nickel), ⅛-in. or 3/16-in. diameter, depending on the thickness of the metal and the extent of the repairs.

DON'TS THEY PRACTICE

Here are some useful tips:

Avoid weaving the electrode from side to side. This creates excessive heat in the casting, which can cause hairline cracks.

Grind the break to a low angle. A wide groove allows the molten weld metal to flow or spread out over the surface.

Preheat prior to welding. In addition to removing grease or oil that has soaked into the casting, preheat speeds welding. If it isn't done, there will be porosity and cracks.

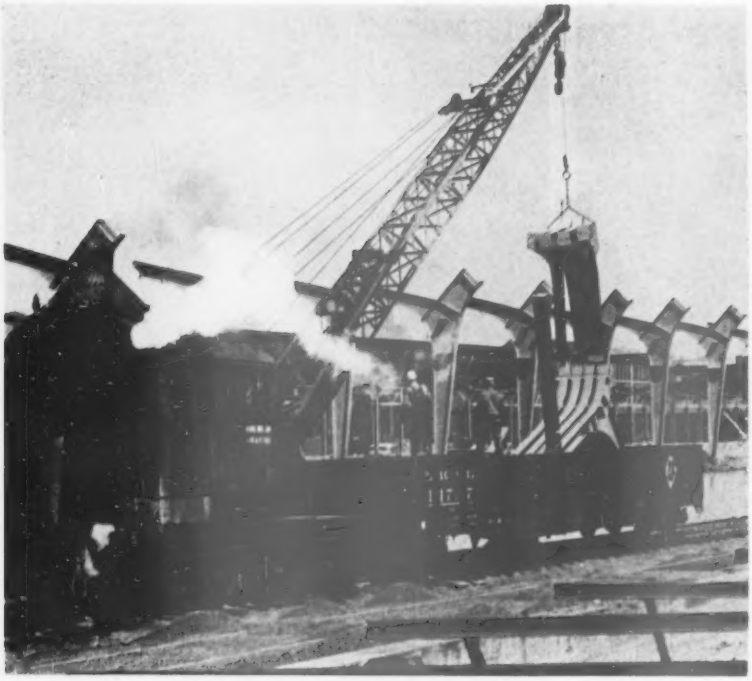
Watch out for undercutting. Undercutting is caused by excessive amperage, improper manipulation of the electrode or by an attempt to weld in a position for which the electrode is not designed.

POSTWELD TREATMENT

After a valve seat has been built up, the casting is placed back into the furnace and allowed to cool slowly. When all eight repaired heads have cooled, the valve seats are reground. All openings in the head are closed, and its water jacket is filled with kerosene for a 90-psi air test. Leakers are rewelded. Repaired blocks are checked with a dye penetrant.

These simple repair procedures prolong the engine life of an average bus to eight or ten years. In its first year, the bus is run about 50,000 miles—each succeeding year a little less. In its last two or three years, the bus is used only for rush hours and probably averages no more than 5,000 miles annually.

Photos courtesy International Nickel Co.



PREFABRICATED columns and other structural members were erected, if possible, as unloaded. Rails in foreground provide a level table to . . .

Weld freight station

FLATCAR was loaded with engine-driven arc welders to provide current. Note the main roof trusses and their junctions with the tapered columns

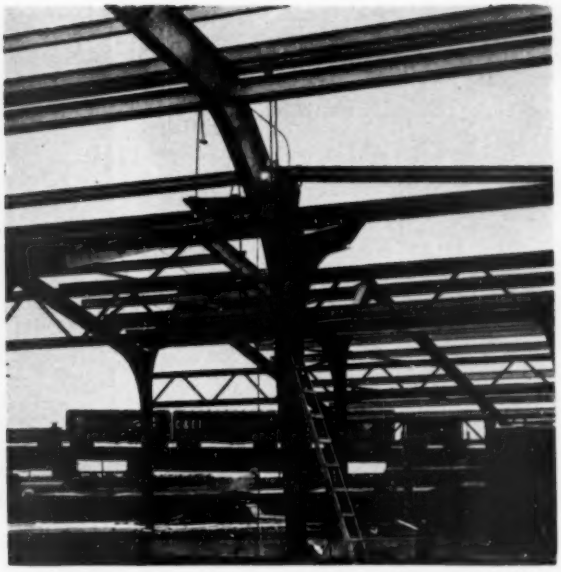
MAIN truss halves were bolted to hold alignment during welding

EXPANSION joints were placed on each side of each roof truss

THE largest rigid-frame welded steel building in St. Louis—the new Miller Street consolidated freight terminal—was recently erected by the Missouri Pacific Lines at a cost exceeding $1,500,000. It replaces two old freight stations that were in service for over 60 years.

Bringing all MoPac LCL freight shipments together under one roof, the new terminal provides warehouse space and island platforms adequate for all incoming and outgoing freight. Twelve railroad tracks lead into the

WOODEN beam acts as "spreader" for hoisting. Right end of truss is bolted, and other end is being located



PERCHED on a swaying platform, weldor completes a manual weld joining roof truss to one of the columns

building, each of 15-car capacity. Thus 180 freight cars may be housed. Loading platforms on both sides of the building provide parking space for 131 trucks.

The final design is a building 314 ft wide and 748 ft long, providing 235,000 sq ft of floor space. There is a two-story "headhouse" across the front—180,000 sq ft of additional floor area for offices and locker rooms. The warehouse areas, which run along each long side of the building, are 50 ft wide, and the two island platforms are each 30 ft wide.

Welded steel construction has made possible many savings on this job! One of the most important savings was in steel—shorter columns were used than would have been possible with riveted construction. The welded, rigid-frame roof construction eliminated need for the horizontal and vertical members found in conventional open-truss joist and rafter construction; consequently, it was possible to provide sufficient clearance for freight cars with shorter columns.

Stupp Brothers Bridge & Iron Co., St. Louis, detailed and fabricated the 1,700 tons of steel required. Several innovations were introduced with regard to steel fabrication and welding. As much of the steel as possible was shop fabricated in order to take advantage of automatic welding.

As an example, the large number of tapered columns needed to support the roof were made by flame-cutting a wide-flange beam diagonally through web from one end to the other. One side was then reversed, and the two webs were submerged-arc welded together to form a tapered column. These columns, like the rest of the structural steel were shipped to the job site in railroad cars to be erected as they were unloaded. This was another cost-saving feature since it eliminated at least one on-the-job handling.

The main trusses were delivered to the job in two pieces. Junk rails were laid on the concrete piers to form a working surface. Aided by jigs, the two halves of each truss were adjusted to the exact pitch necessary for joining them to columns at each end. When the halves were in position, they were bolted together by means of a clip welded to one flange. After the joint had been welded with a heavy fillet bead, the bolts were removed and the clip was flame-cut from the flange and welded on another beam.

A railroad flatcar loaded with engine-driven arc welders provided the welding current.

After the truss had been welded into one piece, it was hoisted into place by a steam crane. A 12 by 12 in. wooden beam spreader for the hoist hitch allowed chains to be attached to each side of center. Balance was maintained, and each member could be hoisted in a horizontal position. Men with ropes at each end of the truss swung it to the correct lateral position. As soon as one end of the truss was in place, it was bolted to the column to hold it temporarily while the other end was being located. A high boom setting on the crane, enabled a truss to be set and bolted to the columns in a matter of minutes.

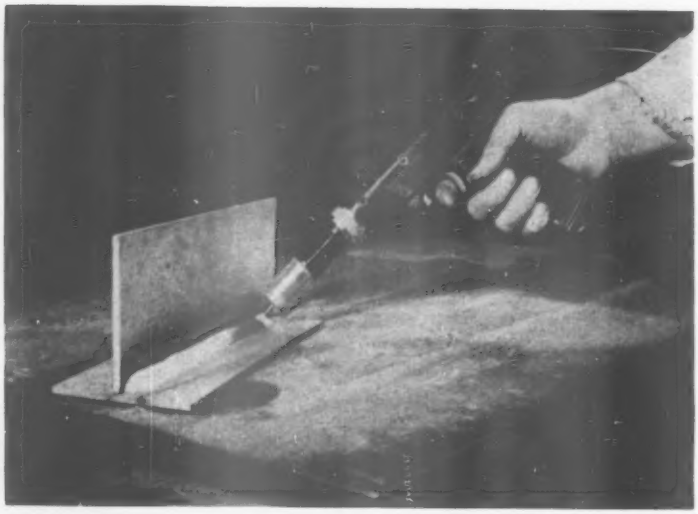
The next job was to weld the column to the truss. This was done manually by weldors working from swinging platforms. Erection bolts were removed after the welds were made, and the bolt holes were filled with weld metal.

Roof expansion joints were among the unusual features of this job. Expansion joints were placed in each truss, one on each side of the main central structure. At each joint, the truss was tied together by a connecting link to allow for expansion. The welded rigid-frame construction made the use of expansion joints possible.

I-beam purlins were bolted in place to the roof trusses, and the entire structure was covered with corrugated asbestos sheet, fastened in place by stud welding. Good natural lighting was obtained by using corrugated wire-glass sheets. These fit the corrugations of the asbestos sheet on the sawtooth roof sections. The glass sheets were set at 30 deg from the vertical to make them self-cleaning.

Photos courtesy Lincoln Electric Co.

PORTABLE control feeds wire at constant rate. Wire feed regulates amperage



WELDING gun is of new type, lightweight and well balanced. It is water cooled to the tip end, minimizing the danger of heat damage

CURRENT is supplied by a constant-potential, 500-amp d-c rectifier welder

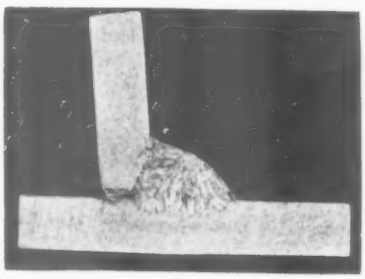
FOUR components—wire, welder, gun and control—are united for welding. For further details of process, see text on opposite page

Mig welding of mild steel

PHYSICAL PROPERTIES

TEMPERATURE—DEGREES F	+80	0	−100	−200
YIELD POINT—PSI	63,200	81,700	90,000	109,200
TENSILE STRENGTH—PSI	76,000	92,400	100,600	111,500
ELONGATION (PERCENT OF TWO INCHES)	279	2585	2550	2713
REDUCTION IN AREA—PERCENT	694	6990	61 30	5790
IMPACT* —FT-LBS	1000	800	220	
IMPACT* E-6020 MANUAL—FT-LBS	58	25	210	

* V-NOTCH CHARPY IMPACT TEST



CROSS-SECTION of a horizontal fillet shows depth of penetration

HIGHER speeds, better quality and lower operating costs are the chief advantages claimed for a new Mig (metal inert-gas) welding process for mild steel, developed by the arc welding department of Westinghouse Electric Corp., Buffalo. According to C. H. Jennings, engineering manager of the Westinghouse arc welding department, field tests on the new process disclose a 15 to 20% faster welding speed at a 25 to 50% reduction in costs.

Other advantages are that there is virtually no spraying nor spatter, and it is possible to produce welds that can be painted without slag cleaning.

Key to the new process is a specially coated wire, the product of five years of research and development. This wire is said to produce its best results when used with a newly designed welding gun, wire control and a constant-potential power source—a 500-amp d-c rectifier welder.

This new consumable-electrode process employs ordinary welding grade argon to shield the arc. Experiments have hitherto been confined to pure argon or to argon with a 1% oxygen addition. As yet, the equipment has not been tested with helium or with helium-argon mixtures.

The equipment may be used on mild steels, with or without normal mill scale, on thicknesses from 1/16 in. up to a limit as yet undetermined. It can be used for either semiautomatic or fully automatic welding, in the horizontal and flat positions only. Butt welds, plug welds and horizontal fillets can all be made.

It's in the Wire

Considering the components separately, the first major advance is in the wire, which is made of mild steel of special analysis and coated by means of a special manufacturing process. The wire is available in four diameters, varying from 0.040 to 0.091 in.

According to Jennings and to H. J. Bichsel (manager, special products section, arc welding department of Westinghouse), the chief contribution of the new wire is to allow the use of straight polarity in Mig welding.

They say:

"The amount of metal an electrode deposits—and consequently the welding speed—is determined by the burn-off rate, the rate at which the electrode burns for a given welding current. The burn-off rate is, in turn, affected by the polarity of the welding process. Using a bare wire with straight polarity (electrode the negative terminal) the burn-off rate is 1.8 times that with the reverse polarity (electrode the positive terminal). However, straight polarity with a bare wire results in poor arc stability, heavy spatter and extremely low penetration, meaning generally unsatisfactory welds. Consequently, the higher burn-off rates of straight-polarity operation are usable only if these major objections can be overcome. The special coating on the new wire makes it posible to take advantage of some of the higher burn-off rates because it stabilizes the arc, eliminates spatter and provides good penetration."

Comparison curves of deposition rates show that the wire-feed speeds with the new wire are from 15 to 22% faster, depending on the welding current used. Since the arc is stable and free from spatter, the feed speed is a direct measure of the actual welding speed for a given size of weld. Hence 15 to 22% faster welding speeds represent corresponding reductions in welding cost.

Saves Argon, Too

Physical properties of the welds are claimed to be superior to those obtained by either automatic or manual coated-electrode processes. Various physical properties have been tested at temperatures from 80 F down to a —200 F. The excellent physical properties at very low temperatures mean a weld metal low in contaminating oxygen and nitrogen.

One of the major costs in an inert-gas welding process is the cost of the shielding gas, in this case argon. Argon normally sells for about 10c per cubic foot, and inert gas processes now on the market use in the neighborhood of 45 cu ft an hour. The new process uses about 30 cu ft an hour, a saving in gas of about 33%. The reason for the lower gas usage is the better arc stability. Each time the arc fluctuates, air is drawn in past the inert-gas shield and consequently more gas is required to prevent dilution of the shielding atmosphere. When the arc fluctuations can be minimized or eliminated, the natural result is a saving in inert gas.

There are definite types of applications where the new process is expected to replace submerged-arc welding. If flux cannot be tolerated because of a dirt hazard (for example in refrigerator compressors) or if the flux cannot be held in place easily (as in small-diameter circumferential welds), then the new Mig process may offer definite competitive advantages. It may also be advantageous where it is desirable to see the weld or where numerous skip welds must be made. However, the new process is not expected to be applicable to present high-current submerged-arc welding applications above 500 amp.

Gun, Controls, Power Supply

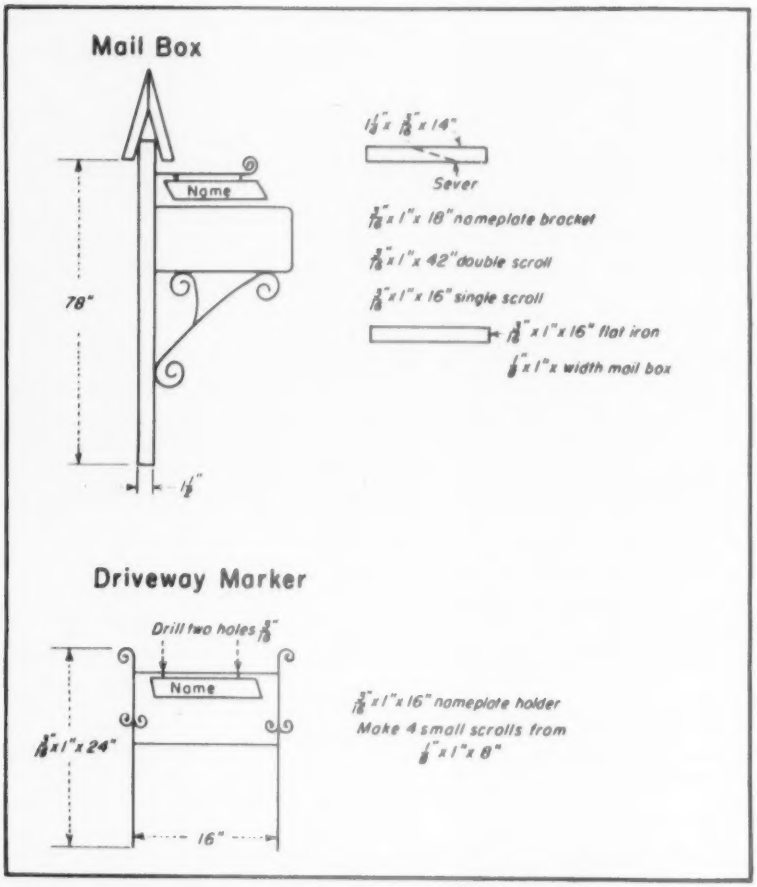
The electrode gun—rated at 500 amp—delivers wire, power, gas, and water. It is light in weight and well balanced. No tubing is exposed, and the tip of the gun is specially designed to be reached by the cooling water.

The control for feeding the wire has been designed to supply wire at a constant preselected speed under all loads. Both of the drive rolls are driven through a 1/12-hp d-c "gearmotor." The electrode length beyond the tip of the gun is controlled on stopping so that neither wire nor operator time is wasted by trimming. Designed for portability, the control panel is light in weight and operates from a conventional 110-volt, a-c supply. An adjustable water pressure switch prevents operation of the gun when the water pressure is below a predetermined limit.

The constant-potential power supply is rated 220/440 volts, 60 cycles, 3 phase. Its continuous current rating is 500 amp at 34-volt load. One of its main advantages is the relatively flat volt-ampere characteristic—the drop from no load to full load is only six volts. This type of characteristic helps greatly in producing arc stability as well as in insuring quick starting and recovery. No current adjustments are necessary at the welder since it is automatically regulated by the rate the wire is fed into the arc.

Other operating characteristics of the welder include an efficiency of about 82% and a power factor in excess of 95% at continuous rated load. Output may be varied from 15 to 40.5 volts. A selenium rectifier provides the d-c power.

Considered separately, each one of the four components—wire, gun, control and welder—can stand on its own as an able performer. Combining the four is expected to make Mig welding of mild steel a truly practical process for industry.


Mail Box
Name
78"
1½"
1½" x ⅛" x 14"
Sever
⅛" x 1" x 18" nameplate bracket
⅛" x 1" x 42" double scroll
⅛" x 1" x 16" single scroll
⅛" x 1" x 16" flat iron
⅛" x 1" x width mail box
Driveway Marker
Drill two holes ⅝"
Name
⅛" x 1" x 24"
16"
⅛" x 1" x 16" nameplate holder
Make 4 small scrolls from
⅛" x 1" x 8"

HERE are Ferguson's drawings for his mail box post and driveway marker

Welding as a hobby

There's pleasure as well as profit in making things that you can sell to your friends and neighbors.

BY JEAN GRANT

CAN welding be a hobby as well as a vocation? Can that equipment bought at a sale and then stored away in the garage be used to make items that can be readily sold?

W. W. Ferguson, of Nashville, Tenn., found that the answer to both of these questions was an emphatic Yes. He has found that there are many products that are easily made with the use of welding equipment and that there are many eager buyers.

Three years ago a friend told Ferguson about a bargain in welders of the farm and home type. He marched down to the store immediately and purchased a 130-amp, a-c machine for two-thirds off. Like most bargains, there was no immediate need for it. The welder stayed in his garage, along with other odds and ends, until one day—

Mrs. Ferguson informed her husband she would like to have a mail box post like the Joneses had. He was so clever with his hands. Could he make one for her?

Ferguson thought about it for a while and decided that he could. The post turned out to be quite a success. So many people expressed admiration that Ferguson decided to make several more and sell them to his friends. He did very well with them until he ran out of friends. The next step, of course, was to sell to the general public. Ferguson soon learned that several hardware stores wanted posts of this type to sell. He now wholesales to seven hardware stores in Nashville.

New Products, New Profits

After the mail box posts turned out so well, Ferguson began looking around for other products that would keep his equipment busy. The driveway marker shown in the sketch was a natural. It is even easier to make than the mail box post and the potential demand is just as great.

Several people asked him to make banisters and handrails for their homes. He has also made gym swings (with and without a sky ride), swing racks for lawn swings, ornamental light poles and clothesline poles.

The scrap pile has proved to be a good source for some of the materials Ferguson uses in making these various products. Other materials are purchased new.

Ferguson's welding equipment is not the most expensive in the world; however, it is enough to get the jobs properly done. He now has an arc welder (purchased at a bargain as explained previously), an oxyacetylene welding outfit, a disc sander, an emery wheel, a motor-driven drill and about $150 worth of other hand tools. A 1932 Ford truck (it cost him $200) delivers the finished products and brings raw materials to the home workshop.

Ferguson believes that anyone with a minimum of equipment can find both profit and enjoyment out of welding as a hobby. Provided he knows his trade.

FERGUSON'S first mail box was designed and built for his own home. Friends wanted one like it and so a new business was born

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surface. The most economical speed of spraying is 3 lb per hour at 80% efficiency. A faster deposit may be made, but the spraying efficiency goes down.

A new type of powder gun, developed in England, sprays and fuses the powder at the same time. It is practicable for thin coatings on flat surfaces and small parts but is not too desirable for round shafts.

There are three methods of fusing the nickel-chrome-boron alloys: (*a*) induction heating, (*b*) controlled atmosphere furnace and (*c*) torch or open flame.

Sam Tour, of Sam Tour & Co., Inc., discussed applications for composite fused-in-place coatings. The self-fluxing types of nickel-chromium-boron-silicon alloys, he said, can be alternated with layers of other metals such as copper, nickel, Monel and stainless steel.

New Slants on Brazing

High-temperature alloy brazing of thin materials for jet engines was discussed in the paper by Arnold S. Rose and William N. Lewis, I-T-E Circuit Breaker Co., Special Products Div., Philadelphia. Their report was concerned with the alloy classified as AWS-ASTM BNiCr filler material, which has a chemical composition of approximately 17% chromium, 70% nickel, 4% boron, 4% silicon, 4% iron and 1% carbon.

This complex multi-component alloy may be considered as being similar in behavior to the 50% copper-50% silver alloy. Because of its composition, it exhibits a marked solvent effect on all steels and nickel-base alloys. A brazing temperature of 2,100 F is generally used.

Three rules for successful brazing were given:

(*a*) The rate of heating through the melting range must be rapid.

(*b*) The length of time the parts are held at the brazing temperature must be kept to a minimum.

(*c*) The amount of brazing alloy placed at the joint must be kept to a minimum.

C. H. Chatfield, senior metallurgist, Handy & Harman, New York City, gave tips on handling metals and alloys difficult to silver braze by standard procedures. These include aluminum bronze, beryllium copper, 17-7 pH stainless steel, chromium carbide, chromium-iron stainless steels, molybdenum, titanium, zirconium and tantalum.

With aluminum bronze, the addition of 15% zinc chloride to the standard silver-brazing flux will eliminate the formation of black residue, which interfere with the wetting of the surface and the flow of the brazing alloy.

Most beryllium copper is supplied to the customer in the solution-treated condition. Beryllium copper in this condition can be brazed at temperatures of 1,200-1,300 F and then precipitation hardened at 600 F to develop the hardness and spring properties. The assembly should be quenched as soon as the brazing alloy has solidified.

The problem of brazing the nickel-free stainless steels is not one of obtaining a strong joint but of making a joint that will resist corrosion in humid atmospheres. The formation of a corrosion-resistant bond on nickel-free stainless steel appears to depend upon the deposition of a nickel-rich layer (from the brazing alloy) over the entire area covered. A new alloy has been developed for this purpose.

The direct brazing of aluminum to copper with the aluminum-silicon brazing alloys is unsatisfactory. However, strong, ductile joints can be made by "tinning" the copper with a silver-brazing alloy and then brazing the tinned surface to aluminum with the aluminum-silicon alloy.

Spot X-Ray Technique

Harold Hovland, of Industrial X-Ray Engineers, told how the use of 3-in. spot radiographs is replacing trepanned plugs for weld examination of oil storage tanks. Though trepanning is usually referred to as a nondestructive test, there are many who disagree. Recently the plug repairs on an oil storage tank were spot X-rayed, and 93% of the repairs were found to be defective. The geometry of the void left by the plug makes good repair difficult.

To maintain maximum defect perception, the wavelength must be varied to suit the thickness of steel, said Mr. Hovland. With gamma rays from radium or from the various new radiosotopes, there is no such control over wavelength. The radiation from a given isotope remains the same and cannot be changed. The radiographer is in the position of a photographer using a box camera. With X-ray equipment, the wavelength control available permits the operator to select the optimum factors.

Quality Control System

The macro-etch system of evaluating quality of resistance welding was discussed by D. O. Samuelson and F. G. Harkins, both of Solar Aircraft Co., San Diego, Calif. Solar Aircraft uses macro-etch inspection extensively for production inspection. Three single-spot specimens are welded and tensile tested at the start of each shift. From this point on, the production inspection procedure consists of macro-etch tests at the start of each shift, or at the start of each job, upon replacement of electrodes, at intervals of not more than one hour during the run, and at the completion of each job.

J. W. Kehoe and D. R. McCutcheon, metals joining laboratory, headquarters manufacturing engineering department, Westinghouse Electric Co., East Pittsburgh, Pa., discussed a spot-welding schedule developed for widely used 3SH14, 52SH34, 61ST6 and 24ST3 aluminum alloys in thicknesses of 0.032, 0.064, 0.091 and 0.125 in. These are spot welded to similar and to dissimilar alloys and thicknesses on single-phase, 60-cycle frequency equipment. Standard slope and taper controls are used, with and without dual welding forces. On work which is to be welded to military specification standards, it is important to use low-inertia force systems.

Surface resistances were checked immediately after cleaning and frequently just before welding by several instrumentation devices. A surface resistance of 50 microhms or less was considered as a standard, after some checks had indicated that this would give clean welds. It was found that when the period between cleaning and welding was lengthened considerably (3 to 4 days), the surface resistance increased very rapidly—from 50 microhms to infinity.

In the flash welding of high-strength alloy steels, the flashing cycle is much, much more critical than it is usually considered, declared W. G. Fassnacht, assistant chief metallurgist, Bendix Products Division, Bendix Aviation Corp., South Bend, Ind. Two conditions to be avoided are "freezing" (from underheating) and the

There's no "...or equal" for EASY-FLO and SIL-FOS

EASY-FLO and SIL-FOS are the original low-temperature silver brazing alloys conceived and perfected by Handy & Harman metallurgists.

Years of research went into the development of the alloys and the manufacturing methods and quality controls used in their production. In composition, in physical properties and in unvarying uniformity, EASY-FLO and SIL-FOS alloys stand alone.

It is from these exclusive features that EASY-FLO and SIL-FOS alloys get their remarkably fast brazing action and ability to make high-strength, liquid and gas-tight joints, consistently and at surprisingly low cost. That's why there's no *"or equal"* for EASY-FLO and SIL-FOS alloys when it comes to fast, reliable, economical metal joining.

and there's no "...or equal" for these SERVICES

The following technical and practical assistance is available, without cost or obligation, to all users of EASY-FLO and SIL-FOS alloys through Handy & Harman's engineering and research departments, field service staff and nearest distributor.

DEMONSTRATIONS of EASY-FLO and SIL-FOS silver brazing in your own shop.

SURVEYS of your metal joining to determine if and where EASY-FLO or SIL-FOS brazing can benefit you.

DESIGN AID for your engineers to assure best joint design for EASY-FLO or SIL-FOS brazing.

SAMPLE BRAZING of your parts by our technicians to determine the best way to silver braze them.

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OPERATOR TRAINING of your key men in our brazing schools, or by a program we set up in your plant.

RESEARCH in our laboratories to work out your special silver alloy brazing problems.

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You can get the real EASY-FLO and SIL-FOS alloys, and their companion low-temperature HANDY FLUX, only from Handy & Harman Authorized Distributors. They're located in principal centers throughout the country. Write for the "Distributor List" and contact the nearest one.

BULLETIN 20 contains the full facts about EASY-FLO and SIL-FOS. It makes clear why these alloys are being used today, in tremendous quantities throughout all industry. It also includes useful information about joint design and fast brazing production methods. Write for a copy.

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production of detrimental "penetrators" (from overheating).

Freezing is a condition in the flashing cycle wherein too much of the cross-sectional area is in contact at one time. This causes the current density in the local shorts to become so low that the explosive forces produced during flashing are too small to blow out the molten pools. When this happens, flashing is arrested.

Penetrators or "flat spots" are weak areas found in completed welds. They may or may not be detrimental to the strength of the weld, depending upon size, but even the smaller penetrators will force a break into the weld line and decrease the ductility.

A. L. Quinlan, of Western Electric Co., told how automatic percussion welding is being used by his company to weld contacts to the ends of the wires for the Bell System's new wire spring relay. Heating time is only 0.2 to 0.3 milliseconds. Capacitors are charged to an accurate high potential (around 1,500 volts) and discharged by arc between the parts as they approach each other under spring pressures. Up to twelve welds can be made on one part in 4 seconds.

T & P Builds Own Cars

In the little East Texas city of Marshall, near the midway point of the 83-year-old Texas and Pacific Railway system, the old locomotive and car repair shops have been converted into an efficient carbuilding plant. In 1955, the railroad plans to build 200 boxcars and 15 cabooses and will continue to build its own cars in the future. Here are some of the highlights, as given by Hugh D. Hollis, mechanical engineer, Texas and Pacific Railway Co., Dallas, Texas:

"Welds must be properly made. We purchase structural steel of not more than 0.20% carbon content, and we consider that the weldability of the steel is more important than the minimum tensile strength. Every effort is made to use submerged-arc welding. Hand welding is confined mostly to tack welding and to short, inaccessible welds that cannot be taken care of automatically. Submerged-arc welding makes a stronger and cleaner weld, does not depend so much on the skill, judgment and integrity of the weldor."

Automatic hardfacing with mild-steel electrodes and agglomerated alloy fluxes was the subject of J. S. McKeighan, The Lincoln Electric Co., Cleveland. Standard submerged-arc automatic welding equipment is used. In combination with a mild-steel electrode, the agglomerated flux contains sufficient alloys to produce a high-quality electric-grade steel in the weld metal.

A mechanized flame descaling set-up for the priming and painting of one-ton steel plates was described in the joint paper by C. H. Cowan, methods engineer, Higgins, Inc., New Orleans, and J. R. Kirwin, cutting specialist, Air Reduction Sales Co. Avondale Marine Ways, Inc., a New Orleans shipyard, was having difficulties in handling a Navy contract to build 64 landing craft, for which some 9,000 plates 7 ft wide by 40 ft long had to be painted. A crew of 20 men could flame-descale and paint only five such plates in an hour's time.

This bottleneck was done away with by handling the plates on edge, in an inclined position. The bottom edge of each plate is supported by grooved rolls, while a side of the plate rests on racks that are tilted about 7 deg off the vertical and spaced 4 ft apart. An overhead chain conveyor with a wire rope pendant clamped to the plate is used to draw it through the installation. Electric chain hoists mounted on trolley beams at either end provide a simple means for lifting plates onto the conveyor rack.

The plate is subjected to sudden, intense heat, developed by twin banks of 15 (on a side, 30 in all) 6-in. flame-descaling tips. A single pass between these powerful burners suffices to loosen scale and dehydrate the plate surface.

Descaling and painting as now set up at Avondale require only ten men: two at the loading end to attach the plate to the chain hoist, one to attach the clamp end of the wire rope pendant to the plate, two torch operators, the crew chief, two men to spray on the paint and two unloaders. In a single hour, 22 plates are fully prepared—an increase of over 400% from manual methods.

How Mig (metal inert-gas) welding was successfully adapted to the fabrication of mild-steel compressor cases was told by John L. Lang, welding engineer, Lukenweld Division of Lukens Steel Co., Coatesville, Pa. The production line was originally set up to produce 40 units per eight-hour work turn or 200 compressors per week, on a one-turn basis. After two weeks, however, 300 units a week were produced on a one-turn basis.

Component parts were cleaned of oil, dirt and scale by grit blasting. Anti-spatter paint was applied where manual metal-arc welds were to add fittings, but care was exercised to keep this material away from areas to be Mig welded as it caused an unstable arc.

A "hand" welding gun was mounted on a carriage riding on a beam. It was so mounted that it could be moved in three directions by the operator without changing its principal angularity. The gun was then operated automatically without other changes being made. The shielding gas was argon with oxygen, and the average consumptions at each of two weld stations were 1.5 cu ft and 3.05 cu ft.

Educational Lectures

This year's Educational Lecture series was dedicated to the memory of the late Dr. Wendell Hess. The two lectures were capably delivered by Dr. Ernest F. Nippes, Dr. Hess's successor at Rensselaer Polytechnic Institute. His subject: the application of temperature measurements in welding research.

With an attendance around 1,400, this convention stood up very well to the attendance records of past AWS conventions. Around 250 bought tickets for the national dinner.

A word of praise should go to the many men (and their wives) of the Chicago Section who labored to make this convention a success. In particular, praise should go to A. R. Meyer, L. C. Monroe and to the following members of Chicago arrangements committees:

J. C. Savage, Linde Air Products Co., dinner; A. P. Bunk, Chicago Bridge and Iron Co., hospitality; H. H. Comstock, National Cylinder Gas Co., ladies' entertainment; L. S. McPhee, Whiting Corp., meeting sessions; R. C. Becker, International Harvester Co., plant visits; W. C. Pearson, Westinghouse Electric Corp., president's reception; T. B. Jefferson, Welding Engineer, publicity; A. G. Craske, Arcos Corp., signs; W. C. Lilly, Certified Weld Bureau, ticket sales; I. H. Carlson, Crane Co., A. F. Chouinard, National Cylinder Gas Co., T. H. Swisher, Hotpoint Co., members at large.

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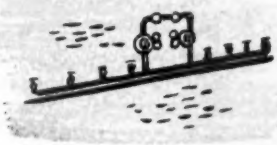

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Tips on Troubleshooting. What to Do if ---

If starter won't operate

¶ Power circuit may be dead. Check voltage.
¶ Power lead may be broken. Repair.
¶ Supply voltage may be wrong. Check against nameplate.
¶ A power switch may be open. Close it.
¶ A fuse may be blown. Replace it.
¶ Overload relay may have tripped. Let the welder cool and remove the cause of overloading.
¶ An open circuit to starter button. Repair.
¶ Operating coil is defective. Test and replace.
¶ There is a mechanical obstruction in the contactor.

If welder won't start though starter is operating

¶ Motor connections may be wrong. Check connection diagram.
¶ Supply voltage may be wrong. Check.
¶ Rotor is stuck. Try turning it by hand.
¶ Power circuit has become single-phased. Replace fuse or repair open line.
¶ Starter has become single-phased. This calls for a check of the contact tips. See that all fingers on starter make contact when closed.
¶ There may be a poor motor connection. Tighten it.
¶ An open circuit in the windings. Repair.

If welder starts but blows a fuse

¶ Fuse is too small. Replace with fuse two to three times rated motor current.
¶ Short circuit in the motor connection. Check starter and motor leads for insulation.

If welder won't hold current setting

¶ Commutator may be rough or dirty. Clean and true.
¶ Brush grade may be wrong. Replace brushes.
¶ Brushes may be worn down. Readjust or replace.
¶ Brush pigtails may be damaged. Replace brushes.
¶ Brushes may be in backwards. Reverse. Or not properly fitted. Sand them to fit.
¶ Brush springs may have lost tension. Readjust or replace weak and broken springs.
¶ Field circuit may have variable-resistance connection or an intermittent open circuit. Check field current of main generator and exciter with ammeter.
¶ Electrode or ground connection may be loose. Or you may have a poor ground. Tighten loose connections and check ground-return circuit.
¶ Field rheostat or tap switches may be making poor contact and overheating. Inspect rheostat. Clean and adjust finger tension on switches.
¶ Mechanical current-adjusting mechanism may have loose or worn links. Check backlash and play.

If welder runs but soon stops

¶ It may be overloaded. Check load against nameplate.
¶ Duty cycle may be too high. Check time set runs.
¶ Leads may be too long or too narrow in cross-section. They should be large enough to carry the welding current without excessive voltage drop. Check terminal voltage while welder is loaded; it should not exceed 30 volts on small welders or 40 volts on larger machines when they are operating at rated current.
¶ Power circuit is single-phased. Check for one dead fuse or a dead line.
¶ Ambient temperature is too high. When temperature is over 100 F, operate welder at reduced loads.
¶ Ventilation is blocked. Check air inlet and exhaust openings.
¶ Overload relay parts overheat. Renewal parts are recommended.

If welder fails to generate

¶ It may be running the wrong way. Check direction of rotation by manufacturers' instructions or with direction arrow. On three-phase motors, direction of rotation may be changed by interchanging any two leads.
¶ Brushes may be worn or missing. Check to see that all brushes bear on commutator with good tension.
¶ Brush connections may be loose. Tighten.
¶ Exciter may not be operating. Check exciter output voltage wih a voltmeter or lamp.
¶ Field circuit of generator or exciter may be open.
¶ Check for open circuits in rheostat, field leads and field coils. Also check resistors and rectifiers if any. Some machines give low output when fields are open.
¶ Generator may be reversed in polarity due to another machine or incorrect operation in parallel with another machine. Flash the field with a storage battery or another generator, first with one polarity and then with the other, to see if it builds up. Flash exciter field if set has separate exciter.
¶ Series field and armature circuit may be open-circuited. Check with test lamp or bell ringer.
¶ Driving speed may be wrong. Check nameplate rating against actual speed of motor or belt drive.
¶ Dirt may be grounding field coils. Clean and reinsulate coils.
¶ Welding terminal may be shorted. Check to see if electrode holder or welding cable is grounded.

If arc is loud and spatters excessively

¶ Current setting is too high. Check setting and output with ammeter.
¶ Polarity is wrong. Try reversing the polarity or an electrode of opposite polarity.

If arc is sluggish

¶ Current is too low. Check output. Also check the current recommended for the electrode being used.
¶ There is a poor connection somewhere. Check all connections of electrode holder, welding cable and ground cable.
¶ Cable may be too long or too small. Check cable voltage drop.

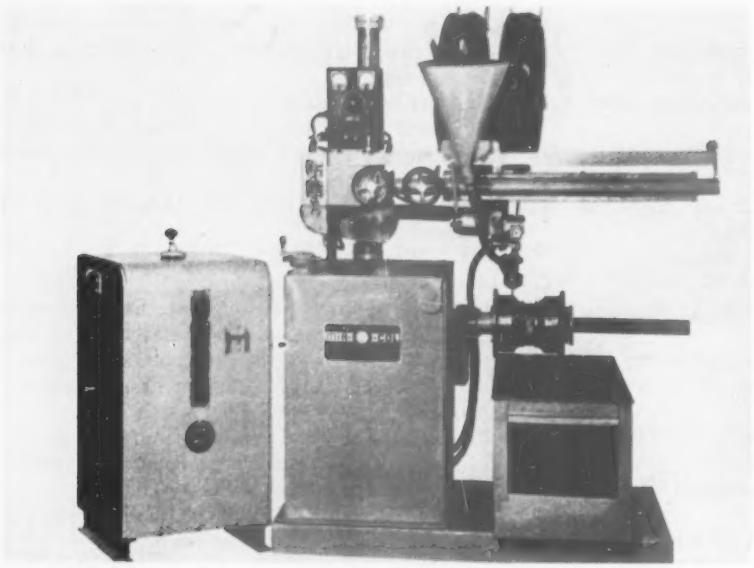
If touching the set gives a shock

¶ Frame is not grounded. Ground solidly.

If control fails to vary current

¶ Any part of the field circuit may be short circuited or open circuited. Find faulty contact and repair.

new products . . . . . USE CARD ON PAGE 89



SIMPLIFIED adjustment of moving parts is feature of automatic rebuilder

COIL supports "float" in bushing

Automatic welder

50 AUTOMATIC submerged-arc welding machine is for rebuilding new and worn parts. Designated the "K-2M," it is claimed to be versatile enough to handle practically any shape work. Cylindrical pieces up to 40 in. in diameter can be locked onto rotating shaft, or the entire boom can be swung around to the side for rebuilding on a stationary or rotating table.

Flux hopper is self-contained and travels with welding head. The machine incorporates features that simplify adjustments of its moving parts. For most applications, unit needs no anchoring to floor. Enclosed base prevents flux from sifting over motors and working parts. Machine can be used with all types of automatic wire up to 1/4 in.

MIR-O-COL ALLOY CO., INC.

* * *

Electrode

51 COVERED manganese-bronze electrode is for high-speed, metal-arc welding of manganese bronze and yellow brass castings and sheet and plate. Designated "Mang-Trode," it is claimed to operate at relatively high current densities on d-c reverse polarity for fast deposition. It can be applied at room temperature without excessive preheat and interpass temperatures. Mechanical properties match those of manganese bronze. Offered in diameters of 1/8, 5/32, 3/16 and 1/4 in. in 50-lb cartons.

AMPCO METAL, INC.

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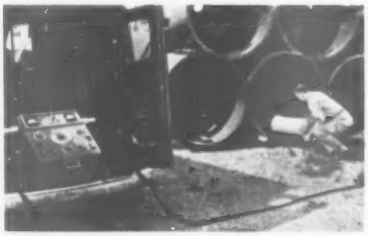

Portable X-ray

52 RADIOGRAPHERS can attain new highs in inspection efficiency with a new type of portable industrial X-ray unit because it is capable of producing a 360-deg radiation sweep, according to manufacturer. Many products can be set up in a circle around the "business head" of the machine and all can be X-rayed with a single exposure. The unit can be placed inside a pipe or pressure vessel and used to take "inside out" X-ray views.

Known as model "OX-175," the machine consists of a tank to house the X-ray tube linked to control and power source by interconnecting cables. Tube head weighs less than 185 lb, has a diameter of 10½ in. and is 42 in. long. Small control case, 18 by 18 by 14 in., weighs 145 lb. Unit can be mounted and used in many different ways.

GENERAL ELECTRIC CO.

A-c welder

53 "BUMBLEBEE" is the designation for a new line of low-maintenance, high-speed a-c welders. These NEMA-rated 300, 400 and 500-amp models feature stepless current control, silicone insulation, aluminum coil windings and a large current scale that can be read from a distance. Fingertip current adjustment and quieter operation are made possible by a new feature in which coil supports float in a special rubber bushing.

Current ranges on the three models are, respectively, 38 to 375, 52 to 500 and 65 to 625 amp. Units are especially suited for heavy section welding where high current is desirable and when arc blow would otherwise cut speed and quality.

AIR REDUCTION SALES CO.

* * *

Resistance welders

54 SPOT and projection welders, "SP2" and "EP2," are single-phase, air-operated machines available in 100-kva and 150-kva at 50% duty cycle. The latter can be supplied in throat depths from 12 to 30 in., while the former can be supplied in 18 to 48-in. throat depths. The "SP2" has an electrode force of 2,250 lb to 4,000 lb maximum, depending upon throat depth; "EP2" has force of 3,000 to 4,000 lb, dependent on throat depth.

SCIAKY BROS., INC.

Argon gas being used as a backing agent replacing backing rings . . . Welding operations are fast and simple.

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in Stainless Steel Piping with HELIARC Welding

Trade-Mark

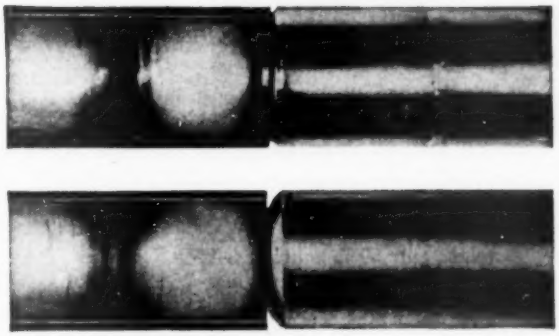
The combination of stainless steel pipe and HELIARC welding with argon gas backing produces a corrosion-resistant piping system—ideal for handling foods, fluid metals, corrosive liquids, high-pressure and high-temperature steam, and pharmaceutical products.

No backing rings—argon replaces the atmosphere in the section of pipe to be welded, and protects the weld bead from the underside as it is formed. This eliminates the need for metal backing rings.

New torch techniques allow the operator to control the size and shape of the penetration bead inside the pipe, while he is making the weld.

Smooth, sound joints—every time. HELIARC welding produces joints free from obstructions, notches, and crevices which hinder or trap flowing materials within the piping system. The penetration bead in the pipe is held within 1/32-in. of the pipe's normal inside diameter.

For the full story on argon-backed, stainless steel pipe fabrication, ask your local LINDE representative for the booklet, "Inert-Tungsten Arc Welding of Stainless Steel Piping," F-8463. In addition, he will be glad to give you complete information on how HELIARC welding cuts time and cost in many other applications. Start saving now—call him today.



Top—interior and exterior of completed welds without argon backing. Bottom—with argon backing, note the smooth, porosity-free, high quality welds.

Linde Air Products Company

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Linde Trade-Mark

"Heliarc" and "Linde" are registered trade-marks of Union Carbide and Carbon Corporation.

Safety hat

55 NEW line of fiber-glass safety hats meets general industrial requirements and federal specifications for electrical resistance, impact and penetration by falling objects, flammability and moisture absorption, manufacturer states.

A combination safety cap and arc-welding helmet is offered with either fixed or lift-front lens holder. Full-rimmed 14-oz hat and 12½-oz cap (with visor only) are made in grey, white, yellow, green and brown.

JACKSON PRODUCTS, INC.

* * *

Portable arc welder

56 SMALL portable arc welder weighs only 59 lb and will weld with 5/32-in. electrode while operating on any single-phase, 110-volt current. Unit can also be used for cutting, brazing, soldering, preheating and hardfacing.

Low maximum load output is said to eliminate danger of electrical shock. Another advantage: minimum carbon precipation to reduce weld brittleness. "Royal Arc 200A" welds with electrodes from 5/64 in. up to and including 5/32 in.

ROYAL ARC INDUSTRIES, INC.

* * *

Eyeshield

57 DESIGNED for cap-mounting on all types of "Skullgard" protective headgear is a new eyeshield of formed plastic that deflects flying particles. It is hinged so that it can be flipped down into position or up out of way.

MINE SAFETY APPLIANCES CO.

Flame-cutter

58 ACETYLENE flame-cutter follows sharp-angled lines with extreme accuracy while saving a third in gas and working time, according to manufacturer. A differential gear between the two drive wheels permits the machine, known as "Landia Junior," to turn with the burner as a pivot. Outside drive wheel and burner are equidistant from inside drive wheel. When gears are coupled, the outer wheel turns twice as fast as the inner one, leaving the burner at a standstill. Turn can be made to right or left around pivot. For straight-line cutting, gears are uncoupled, and wheels drive at same speed.

LANDIA MASKIN FIRMA.

—McGraw-Hill World News

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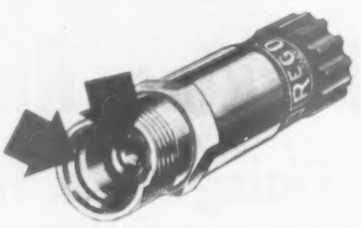


Welding torch

59 IMPROVED model of "Rego GX" torch features Neoprene seating rings in seating surfaces of the torch head. This permits user to make a gastight connection of mixer and torch by hand tightening. It also allows hand-coupling of the cutting attachment to convert instrument to cutting torch. Besides simplifying tip changing, new seating rings will increase torch life and reduce maintenance costs, according to manufacturer.

NATIONAL CYLINDER GAS CO.

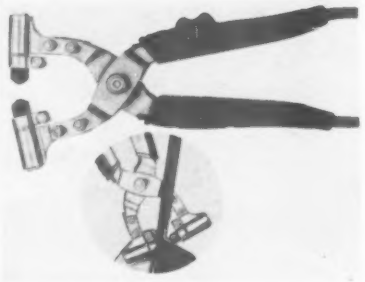
* * *

Powdered-iron electrode

60 DEPOSITS of high tensile strength and excellent ductility are claimed to be put down by this new electrode with powdered iron in the coating. Offering greater speeds and easier welding than conventional electrodes, the "Marq-Rod 12" is for production welding of mild and low-alloy steels. Available in 3/32-in. diameter as well as regular sizes up through ¼ in.

MARQUETTE MFG. CO., INC.

For more information use card on page 89



Spot-welding pliers

61 CAPABLE of working off any automobile storage battery of 6 or 12 volts, spot-welding and soldering pliers generate 2,000-deg heat and can be used on every light job and many heavy jobs, states manufacturer. Designated "Weldall," the tool can be used on steel, stainless, copper, aluminum, iron, wire, heavy brass, bronze, gold and silver.

From the plier handles extend two 6-ft Neoprene-covered cables equipped with battery clamps. If a permanent indoor installation is desired, however, the pliers can be worked off 110 volts, 60 cycles with a transformer giving an output of 6 to 24 volts at 60 to 150 amp.

TIP TOP ELECTRIC PRODUCTS CO.

* * *

Induction heater

62 HIGH-speed induction heater is fast enough to heat a ⅜-in. rod of titanium to 3,400 F in 9 seconds, according to manufacturer. Soldering, welding and annealing of other more commonly used metals can also be accomplished by the "Model 10,000" heater in fractions of a second, it is claimed.

Unit consists of induction coil (size depending upon job requirements), 10,000-watt air-cooled tube, mica silicone transformers and heavy-duty, all-aluminum tank capacitor filled with dielectric synthetic Hectranol.

RADIO FREQUENCY CO.

Valve seat inserts, brazed with REXWELD 64, shown as they leave the furnace. Processed by the Ferrotherm Company for Thompson Products.

REXWELD

for uniform brazing of high-temperature parts use REXWELD 64 brazing powder...

Every lot of Crucible REXWELD 64 brazing powder gives *uniform* high quality. Because of the close melting control used in REXWELD 64 production, the flow point remains constant and furnace temperatures can be maintained.

REXWELD 64 brazing powder, which conforms to AMS 4775, is a nickel-chromium-boron alloy powder designed for furnace brazing of stainless steel and high-temperature alloys. It was chosen by the Ferrotherm Company, Cleveland, Ohio, to join the two sections of the aircraft valve seat shown above. For REXWELD 64 provides good oxidation and corrosion resistance—and higher strength at both high and low temperatures.

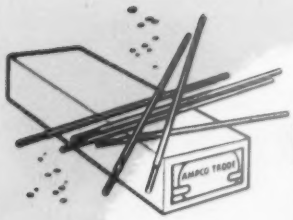
When you have a brazing application involving parts for high temperature service, you can't make a better choice than REXWELD 64 brazing powder. For prompt delivery—or further data on REXWELD 64—*call Crucible.*

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **REXWELD BRAZING POWDER**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

REX HIGH SPEED · TOOL · REZISTAL STAINLESS · ALLOY · MAX-EL · SPECIAL PURPOSE STEELS



Make high-strength, crack-free welds — even on difficult and dissimilar metals

Use all-purpose AMPCO-TRODE* 10 electrodes

HERE'S the electrode that makes many difficult welding jobs a snap. Ampco-Trode 10 gives you strong, crack-free, ductile welds on iron-base metals and alloys — malleable iron, cast iron, manganese steel, tool steel, galvanized, etc. It joins materials such as copper alloys — aluminum bronze, silicon bronze, manganese bronze — and nickel alloys quickly and easily. It lets you join many dissimilar metals — cast iron to steel, cast iron to bronze, bronze to steel, etc. — and deposition rate is fast, too.

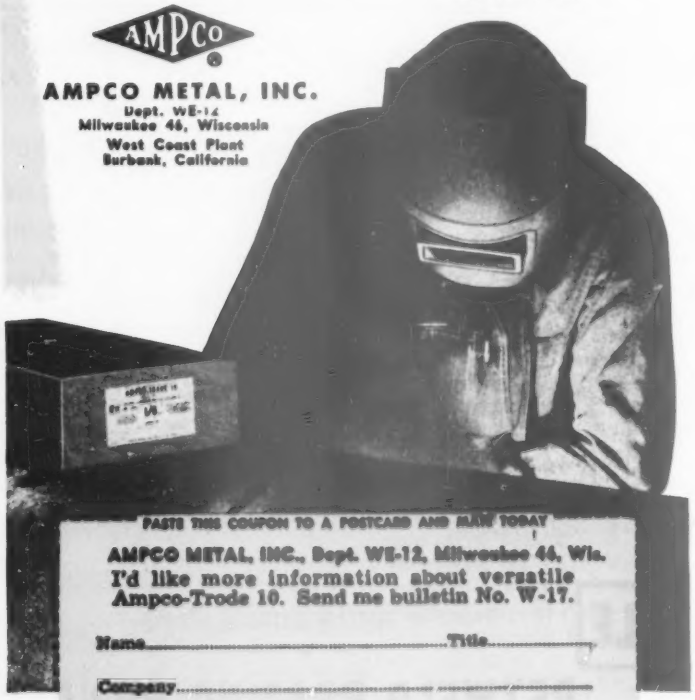
Versatility? You really get it with Ampco-Trode 10. You make intermediate hardness (130-150 BHN) overlays and inlays that have excellent bearing qualities and high resistance to all forms of wear — metal-to-metal, erosion, cavitation-pitting, etc. The deposit resists corrosion from salt water, acids, mild alkalies.

Get convenient Ampco-Trode electrodes in all sizes 3/32" to 5/16", 11" to 18" lengths. Filler rod and wire also in stock for other welding processes. Be set for those tough welding jobs. Order Ampco-Trode 10 today.

*Reg. U. S. Pat Off.

AMPCO

AMPCO METAL, INC.
Dept. WE-14
Milwaukee 46, Wisconsin
West Coast Plant
Burbank, California



PASTE THIS COUPON TO A POSTCARD AND MAIL TODAY

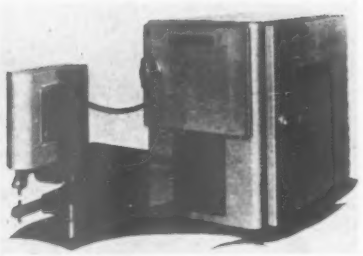
AMPCO METAL, INC., Dept. WE-12, Milwaukee 44, Wis.
I'd like more information about versatile Ampco-Trode 10. Send me bulletin No. W-17.

Name..... Title.....

Company.....

Company Address.....

City..... ( ) State.....

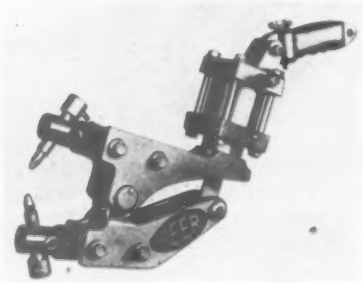


Spot-welder control

63 ELECTRONIC control is for use with manually operated, small spot welders that operate from single-phase a-c source. Such application requires a ½ cycle (or less) precisely timed interval of weld current to be passed while remainder of welder sequence is controlled by other means. Controls and transformer are housed in one unit.

THE TAYLOR-WINFIELD CORP.

* * *



Portable gun welder

64 DESIGNED to "take the machine to the job," a new line of lightweight, heavy-duty gun welders is said to speed production on large sheet-metal and wire assemblies. These portable units are available in 30 to 100-kva capacities for either air or air-hydraulic operation on 220, 440 or 550-volt power supplies.

Six basic gun types are available for special applications. Associated equipment includes water-cooled flexible cables, overhead suspended transformer with balancing arm, timing and contactor controls.

PEER, INC.

* * *

Welding rod

65 NEW welding rod for die-cast zinc, sheet aluminum, cast aluminum and galvanized tin has been announced by this firm. It is said to be especially made for industrial work wherever sheet or cast aluminum is used. It is also claimed to be ideal for use on aluminum boats, house trailers, auto bodies, etc. Available in 35-rod cylinders.

MIRACLE ROD CO. OF ILLINOIS.

WHY IT PAYS TO BUY STAINLESS BARS FROM US

You needn't tie up money in costly inventory

TRIPLE SECURITY

What you want
When you want it
At the right price

• Most manufacturers find the cost of maintaining and handling large stocks of stainless steel is highly impractical. And it's certainly not necessary. For at any U. S. Steel Supply warehouse you always have the widest selection of types, grades and sizes of stainless—top quality, dependable USS Stainless Steel—within easy access.

Why not let *us* carry your inventory? Our larger stocks mean quick and easy procurement... and greater flexibility in design.

In addition, our experienced stainless men will gladly help you with your stainless design problems. They make certain that you always get the best grade for the job.

Next time you want the finest in stainless steel and in service, call the nearest U. S. Steel Supply warehouse. We carry USS Stainless Steel bars — rounds, squares, hexagons, flats, angles, channels — and USS Stainless sheets and strip.

U. S. STEEL SUPPLY
DIVISION

General Offices
208 So. La Salle St., Chicago 4, Ill.

USS

Warehouses and Sales Offices
Coast to Coast

UNITED STATES STEEL

—MAIL COUPON FOR FREE LITERATURE—

U. S. Steel Supply
208 So. La Salle St.
Chicago 4, Ill.

Gentlemen:

Please send me, without any obligation, your free literature on USS Stainless bars.

Name .....
Company .....
Address .....
City ..... State .....

New "Missing Link"

automatically PROVIDES INERT GAS SHIELDED ARC ON ANY MACHINE

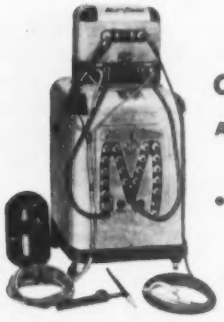
New Model No. 13-D "Missing Link"

New "Missing Link" circuit serves either AC or DC. Needs no auxiliary switch.

The new "Missing Link" No. 13-D, with its advanced-type circuit, converts any arc welding unit into a universal machine *for AC, or DC, inert gas shielded* or metallic arc welding! It is smoother operating and more quiet running than ever. Reduces operator fatigue. And it provides smoother, denser welds.

The 13-D also has continuously variable intensity control . . . precise adjustment for all high frequencies — retaining, of course, outstanding advantages of Mid-States fully automatic gas, water, afterflow and complete operation by remote control.

Send for details today!



Mid-States Model 310, 7-300 amps. with Model 13-D "Missing Link."

Mid-States Arc Welders CUT COSTS with These 7 Features

Automatic Arc Starting • Instant Amperage changes • Welds Ferrous and Non-Ferrous Metals • Unvarying Output, No "Creeping" • No Pressure To Cause Pinholes • No Moving Parts • 100% Penetration — Smoother Beads

ACCEPT Mid-States SIMPLIFIED *WELDING* Brochure *FREE!*

Comes along with "Missing Link" information—complete literature of Mid-States line. Write **today!**

Mid-States WELDER MFG. CO.

6025 SOUTH ASHLAND AVENUE • CHICAGO 36, ILLINOIS

Spot welders

66 SMALL portable spot welders, weighing less than 20 lb each, have arms and weld timers set up as two separate units connected by a flexible lead. Welding transformers, though small, are said to be efficient and are built into the guns. High efficiency is claimed because secondary leads to electrodes are shortened a great deal. Timing equipment is based on electromagnetic principles and is claimed to guarantee even results regardless of condition of metal. Operator presets controls and continues to work without having to readjust welder or use skill and judgment, manufacturer claims.

A. R. O. MACHINERY CO. LTD.

* * *

Radius marker

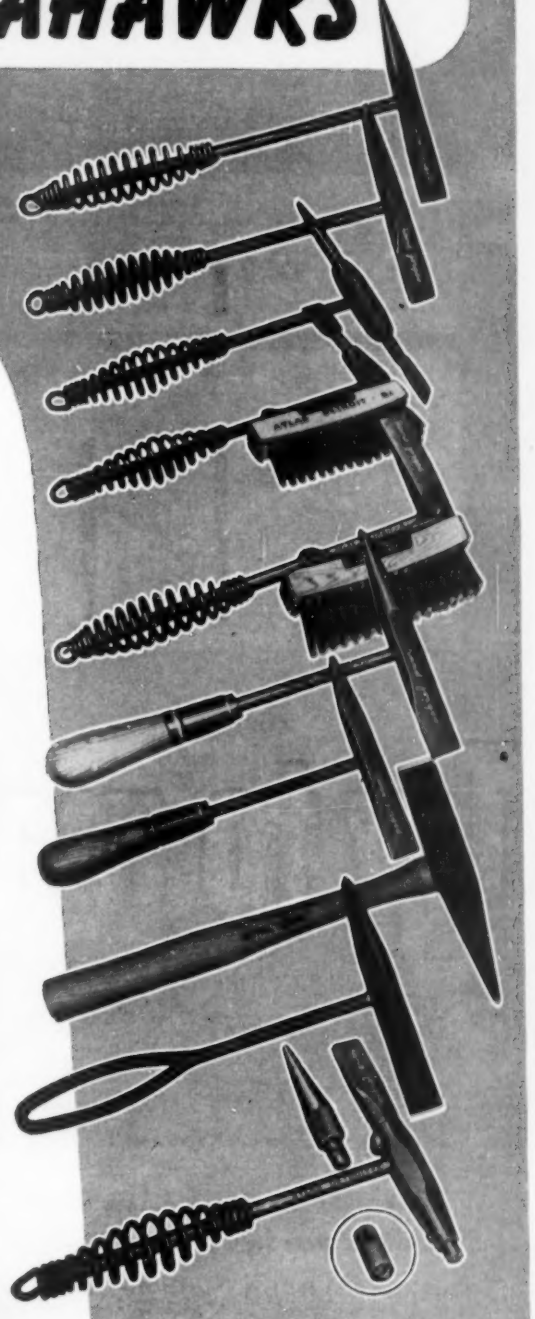
67 WELDORS doing layout work will find this new radius marker a handy tool, manufacturer states. It has a span of 24 in. and is designed to fold into a pocket-size unit measuring only 9¼ in. and weighing but 8 oz. Joints in folding arms are equipped with special spring washers to maintain accuracy and rigidity for years, it is claimed. Pencil holder is made to hold round or flat pencils, soapstone or steel point.

CONTOUR MARKER CORP.

For more information use card on page 89

"ATLAS TOMAHAWKS"

"Re-Bit" Models
E-1—9", 12 oz.
F-1—10", 16 oz.



Featured above is ATLAS' "Re-Bit" tomahawk. Economical to use because chisels and cones can be replaced when worn at low cost. Bits attach to heads with simple locking taper and can be set at any desired angle. Will not jam but drift out easily. Also available with wood grip. Ask your dealer to show you the complete Atlas line of weld cleaning tools.

PROVED PRACTICAL ATLAS WELDING ACCESSORIES

Atlas WELDING ACCESSORIES CO.

707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.

Typical Fillet Speeds

Electrode Size	Amps., AC	Fillet Size	Speed, in./min.
3/16"	290	1/4"	15
7/32"	325	5/16"	15
1/4"	395	3/8"	15

Deposition Rates

DH-5			E-6012
Electrode Size	Amps.	Deposit #/hr.	Deposit #/hr.
3/16"	250	6.8	4.5
3/16"	280	7.9	
3/16"	320	9.6	
7/32"	300	9.0	5.8
7/32"	340	10.1	
7/32"	380	12.0	
1/4"	350	11.2	7.0
1/4"	400	12.8	
1/4"	450	14.7	

Try to match this for

You can't — unless you use the . . . .

Deposits up to twice as many pounds per hour as an E-6012

That's right, the DH-5 is in a class by itself, when it comes to high welding speed and sound deposits in horizontal and flat positions. It's Harnischfeger's answer to the demand for lower welding costs. It's your answer to the need for faster, better work.

Powdered metal in the coating becomes part of the deposit — increases thermal energy and efficiency. By simply dragging the DH-5, the operator gets the speed and bead appearance ordinarily associated with submerged arc welds.

Wherever they've tried it, weldors like the DH-5. It's fast, it's easy to use. There's no splatter. Slag removal is easy and quick. The bead shape is flat and smooth.

The DH-5 has good, as-welded, mechanical properties, too. See for yourself:

Tensile strength - - -	85,000-95,000
Yield strength - - - -	73,000-77,000
Elongation in 2" - - - - -	15-25%

If you're interested in your cost picture — and who isn't, today?—you owe it to yourself to try the DH-5 without delay. See your P&H representative or distributor now.

For further facts, write for bulletin.

P&H WELDING DIVISION

HARNISCHFEGER CORPORATION

4513 WEST NATIONAL AVE. • MILWAUKEE 46, WISCONISN

the P&H *Line*

3996

high-speed welding!

. . New P & H DH-5 Electrode

America's most complete line of arc-welding equipment and electrodes

P&H DC RECTIFIER WELDER

Four sizes — 200, 300, 400 and 500 amps (NEMA-rated). No moving coils to break down — no bearings, brushes, commutator, brush riggings, etc., to replace. Dial-lectric Control gives you fingertip heat control at the work.

P&H AC WELDER

A full range of sizes up to 625 amps (NEMA-rated). All are connectable to 220 or 440 volts. Dial-lectric Instantaneous Remote Control is fingertip control — gives you any heat you want, right at the work.

P&H POSITIONERS

One finger is enough to position heavy weldments for economical downhand welding. Capacities from 2500 to 36,000 lbs. — remote-control and hand-operated models.

P&H WN-250 ENGINE-DRIVEN ARC WELDER

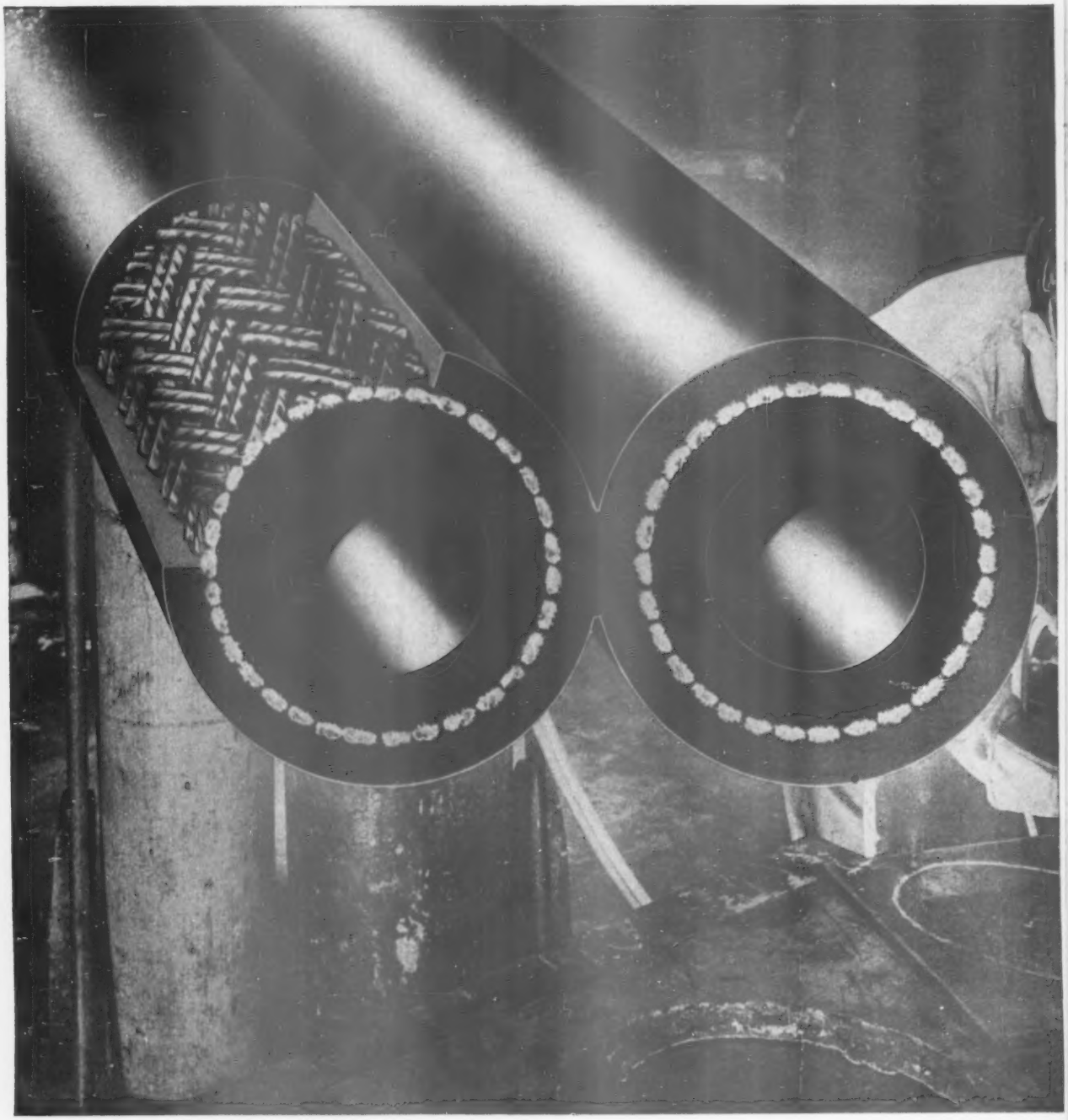
NEMA-rated at 200 amps, but pulls 300 amps. Has full 20-gallon gas tank — runs all day on one tankful. Powered by four-cylinder, 180 GLU, Waukesha, water-cooled, gasoline engine.

P&H Welding equipment is manufactured and sold in Canada by

REGENT EQUIPMENT MANUFACTURING COMPANY LTD.

455 King Street West • Toronto, Ontario, Canada

Safer Twin-Weld® Hose



HEWITT-ROBINS

EXECUTIVE OFFICES, STAMFORD, CONNECTICUT

Won't Writhe or Twist

Hewitt-Robins Twin-Weld—the original Twin-Line Welding Hose—Offers Values Found in No Other Hose... Single or Double Line!

Here is the safest, easiest-handling welding hose that money can buy. Twin-Weld—*the original twin-line welding hose*—won't writhe or twist on the job as other welding hoses do because it's "straight-cured". Its two lines are firmly bonded together, easily separated for making connections. Twin-Weld is non-porous . . . eliminates welding inefficiency, explosions and fires.

For greater safety and maximum flexibility . . . longer welding hose life . . . buy Hewitt-Robins Twin-Weld.

ENGINEERING DATA

TUBE: Non-porous, smooth tube for full free-flowing of gases at all times.

CARCASS: Now reinforced with a single braid of high-tensile rayon yarn, applied with special braiding equipment . . . equal in strength and fabric content to the highest quality two braid hose.

COVER: New flame-resistant, oil-resistant cover made from premium quality synthetic compound that won't become hard or brittle. Surface is smooth . . . won't crack, peel or discolor . . . resists abrasion of sharp metal, heat, grit, dirt and ozone checking. For quick, positive identification oxygen line is green—acetylene line is bright red.

SIZES: O.D.'s now conform to IAA specifications—7/16", 17/32", 19/32" . . . I.D.'s 3/16", 1/4", 5/16".

WORKING PRESSURES: Up to 200 psi.

Here is a partial list of

HEWITT-ROBINS PRODUCTS

that will help you cut handling costs and increase operating efficiency.

MACHINERY

Belt Conveyors
Belt & Bucket Elevators
Car Shakeouts
Conveyor Idlers
Dewaterizers
Mechanical Feeders
Foundry Shakeouts
Mine Conveyors
Reclaiming Systems
Screen Cloth
Stackers & Trippers
Vibrating Conveyors & Screens

INDUSTRIAL RUBBER PRODUCTS

BELTING:

Conveyor
Elevator
Transmission

HOSE:

Acid
Air & Air Drill
Barge Loading
Dust Suction
Fire
Fuel Oil & Gasoline
Gasoline Pump
Mud Pump Suction
Oil Suction & Discharge
Propane-Butane
Road Builders'
Rotary Drilling
Sand Blast
Sand Suction
Sea Loading
Servall®, All-Service
Steam
Tank Car & Tank Truck
Vacuum & Air Brake
Water & Water Suction
Welding, Twin-Weld®

•

For information and service on industrial rubber products, contact your Hewitt-Robins Industrial Supply Distributor. Through his complete stock of Hewitt-Robins Rubber Products, and his familiarity with local field conditions, he can fill your supply needs promptly and correctly. See Classified Phone Book for the Hewitt-Robins Industrial Supply Distributor serving your area.

3449

INCORPORATED

DOMESTIC DIVISIONS: Hewitt Rubber • Robins Conveyors • Robins Engineers • Restfoam
FOREIGN SUBSIDIARIES: Hewitt-Robins (Canada) Ltd., Montreal • Hewitt-Robins Internationale, Paris, France • Robins Conveyors (S. A.) Ltd., Johannesburg • **EXPORT DEPARTMENT:** New York City.

WELDING ARCS NEWS

BY SWITCHING FROM CONVENTIONAL E6012 ELECTRODES TO G-E STRIKEASY 1 IN WELDING FRAMES FOR 20-TON END DUMP TRUCKS

WELDING FOREMAN FOR DART TRUCK CO. SAYS:

"Speed?—G-E Strikeasy 1 electrode saves us

"Not only does General Electric's Strikeasy 1 electrode give us tremendous savings . . . it offers an operating ease that my men and I have never experienced in all our years in welding."

This is the conclusion reached by Mr. E. A. Gassman, Welding Foreman for the Dart Truck Co., Kansas City, Mo.—manufacturers of the largest dump trucks in the world.

DART SAVED OVER 2 MAN-DAYS PER TRUCK, when it switched to the G-E Strikeasy 1 electrode for the welding of frames for its Model 20-S 20-ton end dump trucks. Dart says that this represents a 50% decrease in welding time over the conventional E6012 electrodes which were formerly used.

Such high speeds are realized because Strikeasy 1 uses a nonconductive rutile type coating enriched with powdered metal. When an arc is struck, the metal particles melt off to form part of the bead.

STRIKEASY 1 ELECTRODE IS EASY TO USE. A contact-type electrode, it forms a finely rippled bead when you simply drag it over the job. And less skill is required to hold arc length.

Also, slag practically peels off Strikeasy 1 welds without excessive chipping and cleaning. All this means that Strikeasy 1 helps cut down on operator fatigue—slashes training time for new operators.

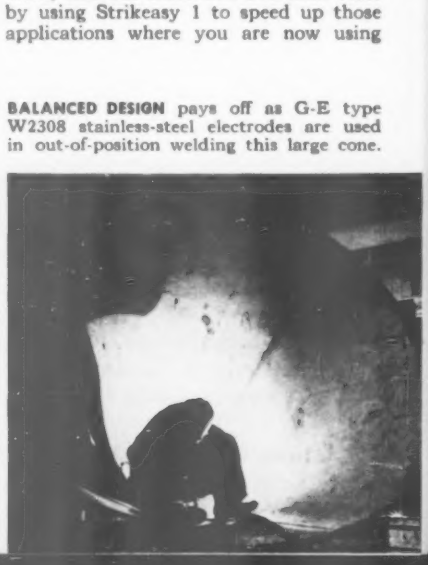
IMPROVE YOUR COMPETITIVE POSITION, and cut labor and overhead costs by using Strikeasy 1 to speed up those applications where you are now using

General Electric Balanced Electrode Design Gives Better Over-all Results

Within any given electrode class, G-E electrodes give your welding applications a balanced combination of speed, weld-quality, and ease of use—for better over-all results. Application tested, "balanced design" is part of the entire G-E line of electrodes—the most complete line in industry.

"QUALITY WELDS" was the order for this Dallas skyscraper. G-E W610A electrode provided necessary fast strength welding.

BALANCED DESIGN pays off as G-E type W2308 stainless-steel electrodes are used in out-of-position welding this large cone.



(SEE INSET), DART TRUCK SAVES OVER TWO MAN-DAYS PER TRUCK. SEE STORY BELOW.

over 2 man-days per truck!"

conventional E6012 class electrodes.

Check your G-E welding distributor's name at the right and in the yellow pages of your phone book; ask him for: GEC-1231—Bulletin on Strikeasy 1; GEL-1196—Wall Chart for Selecting Stainless-steel Electrodes; GED-1634—Electrode Catalog, a pocket-size guide to electrode selection and application. General Electric Company, Schenectady, New York. 710-19

GENERAL ELECTRIC

PREFABRICATED ROOF is all-welded with G-E W612A, which reduces pinholing, slag interference in vertical-down work.

RUGGED EARTHMOVERS for tough mountainous duty are repair-welded crack-free with G-E W1016A low-hydrogen electrodes.

Contact Your G-E Welding Distributor Today

Alabama: Birmingham—Alabama Oxygen, Young & Vann Supply; Mobile—Turner Supply

Arizona: Phoenix—Consolidated Welding Supply

California: Fresno, Los Angeles, Oakland, Sacramento, San Diego, San Francisco, Ventura—Victor Equipment

Colorado: Boulder, Colorado Springs, Denver, Durango, Ft. Collins, Ft. Morgan, Greeley, LaJunta, Longmont, Pueblo, Sterling—Hendrie & Bolthoff

Connecticut: Hartford, New Haven—Harris Company

Florida: Hollywood—Florida Gas & Chemical

Georgia: Athens—Welding Gas Products; Atlanta, Macon—Welding Supply & Service; Augusta—Marks Oxygen; Columbus—Williams Welding Supplies; Gainesville—Welding Gas Products

Idaho: Boise—Gate City Steel

Illinois: Chicago, Moline, Morton, Rockford—Machinery & Welder

Indiana: Evansville—Drillmaster Supply; Ft. Wayne, Indianapolis—Sutton-Garten; South Bend—PerryWelding Sales & Service

Iowa: Des Moines—Machinery & Welder

Kansas: Wichita—Standard Products

Kentucky: Louisville—Reliable Welding; Paducah—Henry A. Petter Supply

Louisiana: Alexandria, Shreveport—Hughes Oxygen; New Orleans—Consolidated Welding Supplies

Maryland: Baltimore—Arcway Equipment

Massachusetts: Boston—New England G-E Welding Sales Division

Michigan: Detroit—Welding Sales & Engineering; Grand Rapids—Miller Welding Supply

Minnesota: Duluth—W.P.&R.S. Mars; St. Paul—Production Materials

Mississippi: Jackson—Jackson Welding & Supply

Missouri: Kansas City—Hohenschild Welders Supply; St. Louis—Machinery & Welder

Montana: Billings—Valley Welders Supply; Billings, Bozeman, Cut Bank, Glasgow, Great Falls, Havre, Kalispell, Miles City, Shelby, Sidney, Whitefish—Valley Motor Supply; Butte, Great Falls—Montana Hardware

Nebraska: Lincoln—Lincoln Welding & Supply; Omaha—Baum Iron

New Jersey: Kenilworth—Welding Sales Corp.

New Mexico: Albuquerque—Industrial Supply Co.; Hobbs—Western Oxygen; Las Cruces, Silver City—Car Parts Depot, Inc.

New York: Buffalo—Welding Equipment Sales; New York—Welding Sales Corp.; Syracuse—Welding Engineering & Equipment

North Carolina: Charlotte—Dixie Gases; Gastonia—Gastonia Motor Parts

North Dakota: Bismarck, Fargo—Acme Welding Supply

Ohio: Akron, Cincinnati, Cleveland, Columbus, Dayton, Mansfield—Burdett Oxygen; Toledo—Odland Iron Works

Oklahoma: Oklahoma City—Hooper Supply; Tulsa—G-E Welding Sales Division

Oregon: Eugene, Portland—J. E. Haseltine; Medford, Portland—Industrial Air Products

Pennsylvania: Allentown, Philadelphia, Pittsburgh—Arcway Equipment

South Carolina: Columbia, Greenville—Welding Gas Products

South Dakota: Deadwood—Hendrie & Bolthoff

Tennessee: Chattanooga, Knoxville, Nashville—Welding Gas Products; Memphis—Delta Oxygen

Texas: Abilene—M&M Welding Supply; Alice, Corpus Christi—Crane Welding Supply; Alpine, El Paso, Marfa, Pecos—Car Parts Depot; Amarillo—Welding Equipment & Supply; Beaumont—H. & W. Welding Supply; Brownsville, Harlingen—Acetylene Oxygen; Dallas—Hill Equipment & Supply; Houston—G-E Welding Sales Division; Lubbock—Welders Supply of Lubbock; Midland—West Texas Welders Supply; Odessa, Pecos—Western Oxygen; Orange—Marine & Petroleum Supply; Pecos—Welding Supply Co.; Plainview—Plains Welding Supply; San Angelo—Southwestern Welding Supply; Texarkana—Hughes Oxygen; Wichita Falls—McGinnis Welding Supply

Utah: Salt Lake City—The Galigher Co.

Washington: Seattle, Spokane—J. E. Haseltine; Spokane, Yakima—Industrial Air Products

West Virginia: Bluefield—Bluefield Supply; Charleston—Virginian Electric; Huntington, Logan—Logan Hardware & Supply

Wisconsin: Milwaukee—Machinery & Welder

Wyoming: Cody, Lovell—Valley Motor Supply Co.

Alaska: Anchorage—Northern Supply

Canada: Toronto—Canadian G.E.

Hawaii: Honolulu—American Factors, Ltd.

AUTOMATIC TORCHES

THE HEART OF ECONOMY

Approved by Underwriters' Laboratories

BY ACTUAL COMPARISON

USING NON-AUTOMATIC TORCH . . . . . 12 Pieces Welded
USING NON-AUTOMATIC WITH GAS SAVER . . 18 Pieces Welded
USING HARRIS AUTOMATIC TORCH . . . . 28 Pieces Welded

Using the same amount of Oxygen and Acetylene for each set-up, this "Actual Comparison" Demonstration proved the Harris Automatic Torch to be a profitable investment for economical and efficient welding work.

Let our local Distributor show you the "Actual Comparison" test in your plant and explain quickly and simply why the Harris Automatic has the greater piece production at the lowest cost.

ALMOST 50 YEARS OF "KNOW-HOW"

Harris is the originator of the "Automatic" Torch and with almost 50 years of building "Know-How" behind every torch, the buyers and users get tremendous returns on their torch investment.

Harris' long established Distributors, located in all principal cities in the United States and Foreign Countries, are at your service.

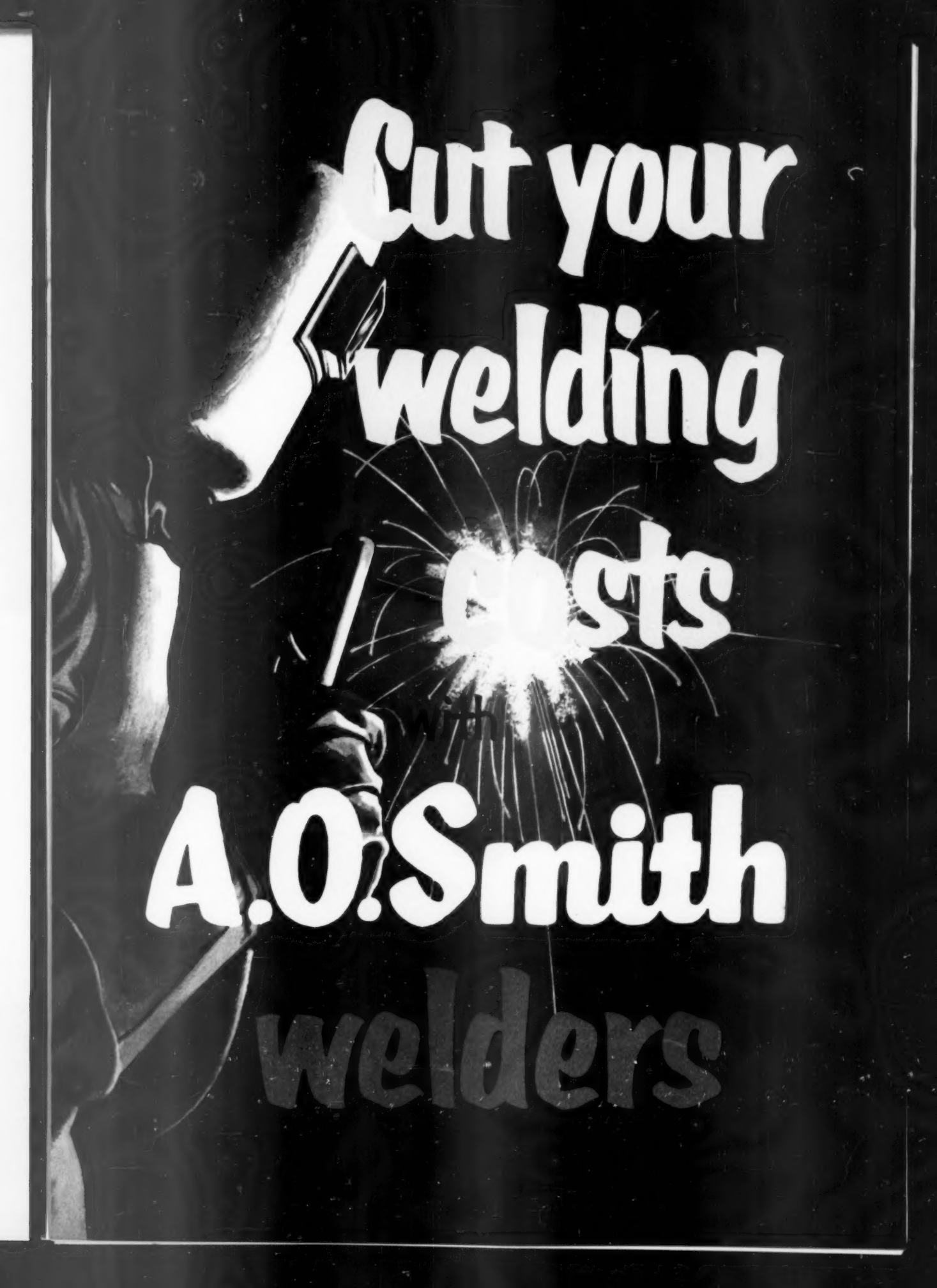
HOME OF AMERICA'S FIRST AND FINEST GAS WELDING AND CUTTING APPARATUS.

THE HARRIS CALORIFIC COMPANY

Cleveland 2, Ohio

HARRIS

SERVING THE METAL INDUSTRY SINCE 1905


Cut your
welding
costs
A.O.Smith
welders

...and get all the

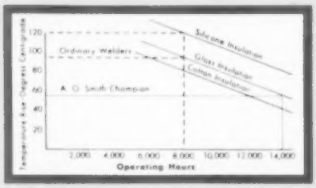
A. C. CHAMPION

heavy-duty welder

Designed and long proved the most dependable power source for continuous operation on the most demanding welding assignments at full rated output.

The CHAMPION has enough copper, plus downdraft ventilation, to assure no more than a 55° C. temperature rise when operating at full rated output. This means almost twice the operating life of any comparable heavy-duty welder!

75 open circuit volts for high-speed welding with a faster and smoother arc! You can "drag the arc" on rapid work and weld low-hydrogen electrodes without "pop-outs." All-weather case makes it as useful outside as in the shop. Available in 300-, 400- and 500-amp models.



The A. C. UTILITY for farms, garages, machine shops with dual welding range: 25-90 amps., 35-180 amps

extra benefits

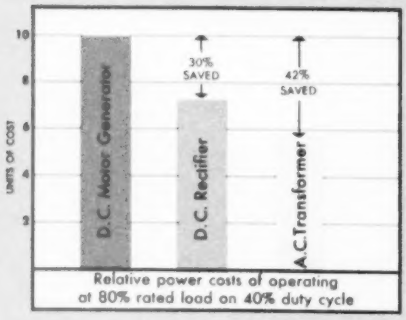
which A. O. Smith design and engineering provide!

D. C.
RECTIFIER
heavy-duty welder

Here is a complete line of N.E.M.A.-rated welding power sources that operate without a single, heavy, rotating part! No motor (other than ventilating fan) and no generator . . . nothing to wear, no commutators to corrode or turn down, no bearings or brushes to replace! Yet they provide a better welding current for all types of work, and operate with unmatched efficiency!

SAVE POWER

Power costs of operating 400-amp. welders are charted below, providing an opportunity to compare motor-generator, rectifier, and AC transformer demands on 40% duty cycle.



Relative power costs of operating at 80% rated load on 40% duty cycle

The savings in power effected by transformer type machines over motor generators result from the improved efficiency under load of the A. C. transformer (85% to 88%) and the D. C. Rectifier (69% to 72%) over the D. C. Motor Generator (45% to 50%), plus the ability of transformer and rectifier to deliver full welding current instantly, when demanded, without requiring large idle-time power to keep rotating parts in motion. The savings are real. In fact, many manufacturers have found that a new transformer will practically pay for itself in a year! Ask your A. O. Smith distributor or representative to show you how, at your next opportunity.

SAVE OTHER COSTS

You save more than power costs when M.G. sets are replaced by A. O. Smith welding machines. Rectifier and transformer welding current inherently has less arc blow, and that means higher quality welds, faster welding speeds and less spatter. It also means greater overall operator efficiency, which assures better weldments, less weld repair and gives the operator greater pride in his work. The result: more money saved and production improved!

Because there are no moving parts, A. O. Smith welders require practically no maintenance. Quiet in operation, they are built to stand up under gruelling production schedules.

Modern successor to the cumbersome, troublesome, lumbering motor-generator set! This welding power source provides smoother arc performance, more dependable amperage at all times, instant striking arcs, and uses power only when welding! It's the only rectifier-type welder designed with high-velocity down-draft ventilation, which draws cool air in over the rectifier stacks before blasting it through the machine. Even when short-circuited at full rated amperage setting, the rectifier stacks remain below critical temperature! Stepless amperage control, effortless and accurate over the full range, assures exactly the desired setting for any job. The three-phase transformer coils are precision wound, of heavy copper, for long service life. Available in 200-, 300- and 400-amp. models.

...e A. C. CHALLENGER all-...rpose welder 200-, 300- and ...00-amp. models

The A. C. AUTO-MAN for automatic or manual use 650-amp. model, up to 4-unit multiples available

There are A. O. Smith welding power sources for every welding need, built to the highest standards in the industry and of advanced design that makes them more desirable than any other make. Job proved in the shops of the world's largest user of welding as a production tool!

It will pay you to replace M.G. sets with A. O. Smith welders. May we suggest that you write us or contact your local A. O. Smith distributor for full particulars.

A.O.Smith
CORPORATION

WELDING PRODUCTS DIVISION, Milwaukee 1, Wisconsin

INTERNATIONAL DIVISION: MILWAUKEE 1, WISCONSIN

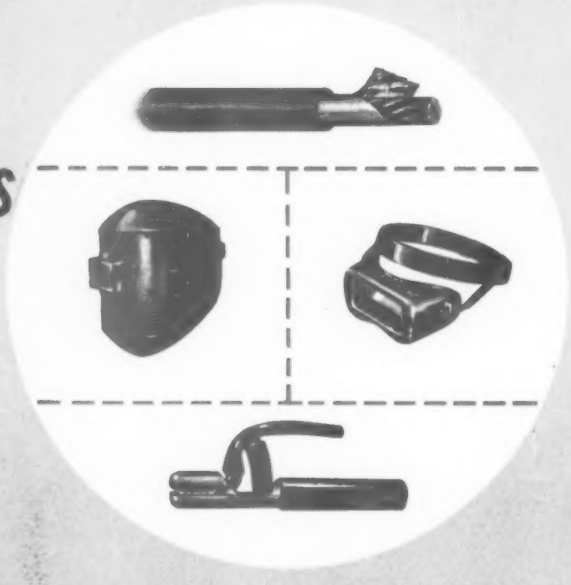
Highest Quality Welding Electrodes

Mild Steel	AWS Class	E6010	E6011	E6012	E6012	E6013	E6013	E6020	
	A. O. Smith	SW10	SW14	SW11	SW17	SW15	SW16	SW35	
High Tensile	AWS Class	E7010	E7010	E7020	E8013	E9010	E9013	E10013	E10020
	A. O. Smith	SW75	SW80	SW76	SW86	SW95	SW97	SW88	SW101
Low Hydrogen	AWS Class	E6016	E6016	E7016	E8016	E9016	E9016	E10016	E12015	E12016
	A. O. Smith	SW64	SW65	SW84	SW81	SW90	SW89	SW100	SW120	SW103

Stainless	AISI Class	502	505	410	430	308	308	309	309	310	310	310	310	310	316	317	318	347	347
	A. O. Smith	SW151	SW152	SW153	SW154	SW162	SW362	SW166	SW167	SW159	SW359	SW169	SW158	SW368	SW160	SW161	SW158	SW157	SW357

Complete line of welding accessories

All the essentials to put welding to work are available through A. O. Smith. Quality welding cable, connectors, splicers, ground clamps, tongs, and holders; helmets, shields, gloves, and protective clothing; electrode storage ovens, machines and electrodes ... everything required for welding can be had from one responsible source. Take advantage of this for all your welding needs.



A.O.Smith
CORPORATION

WELDING PRODUCTS DIVISION

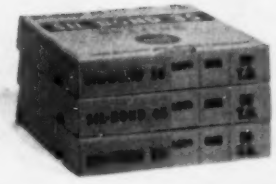
Milwaukee 1, Wisconsin

INTERNATIONAL DIVISION: MILWAUKEE 1, WISCONSIN

Made by welders . . . for welders

United's SIL-BOND

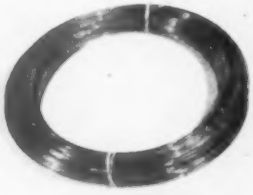
Makes Low Temperature Brazing Easier 3 BIG WAYS

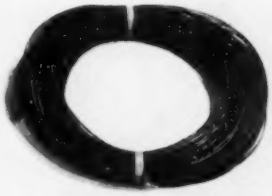


1

IDENTIFICATION FOR INVENTORY CONTROL

Easier to identify for alloy, size, exact weights and laboratory inspection number. Packaged for protection against dirt, oxidation and other contamination.





2

CLEANEST COILS MADE

Compare SIL-BOND coils with any other brand for purity, cleanliness and uniformity of temper . . . comparison is SIL-BOND'S best salesman! (SIL-BOND COIL at left. Other coil at right.)

3

EASIER TO UNWIND

SIL-BOND is better drawn, tighter coiled . . . so it unwinds easier, saves costly preparation time! Important in hand fed brazing . . . vital in automatic brazing!

SIL-BOND — *The Dependable Low Cost, Low Temperature Brazing Alloy!*

Better Because It's Made Better and Packaged Better!

Dependable United Product Analysis Makes The Brazing Difference!

ALWAYS Braze with SIL-BOND or PHOSON!

Ask for SIL-BOND Booklet NOW!

UNITED WIRE

Ask to see the new United Wire color film "When Metals are Brazed". Write for showing dates and literature.

Permanently United

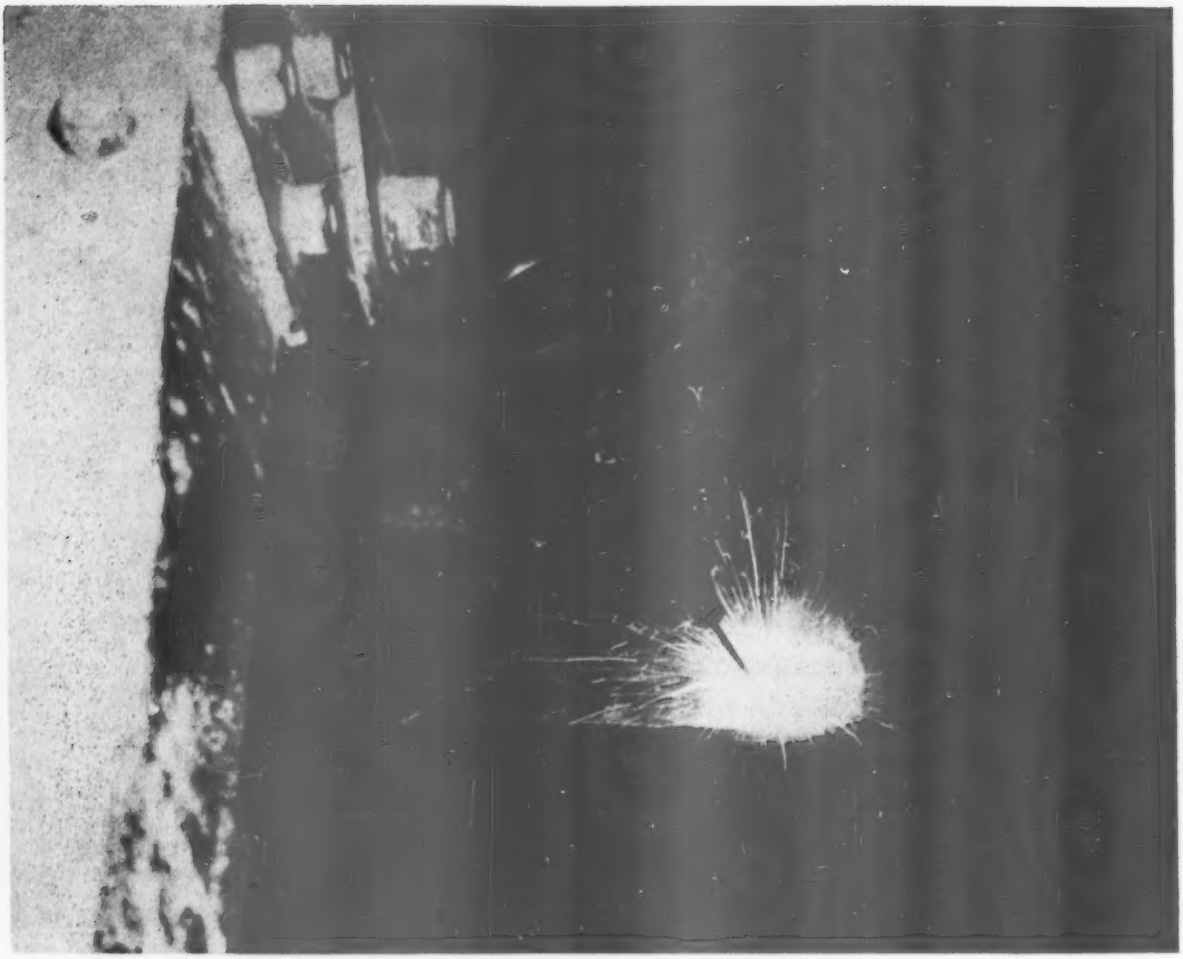
AND SUPPLY CORP.

Brazing Alloy Division

PROVIDENCE 7, RHODE ISLAND

Offices in

PRINCIPAL CITIES



Crusher rolls such as this can be rebuilt with Stoody Magnecote in about half the time with a 30% saving in material cost. Service life is usually twice that of a new roll.

THE STORY OF STOODY MAGNECOTE

A new build-up and hard-facing process that deposits weld metal faster, cuts labor and overhead costs

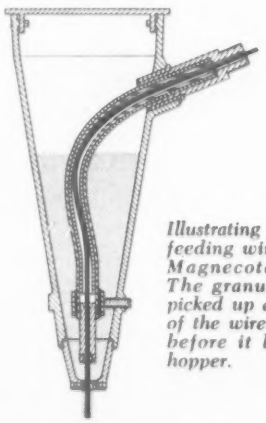
Stoody Magnecote is a new method for making high speed weld deposits. It possesses all the flexibility of manual welding with greater speed than automatic welding. Magnecote's primary applications are building up and hard-facing heavy equipment, crushers of all types, shovel parts and similar heavy sections. Because of its great speed—conservatively 3 times faster than manual welding—*far more work can be accomplished within a given time, labor and overhead costs are reduced accordingly.*

Using an annealed $^{3}/_{32}$" or $^{5}/_{64}$" .60-.70 high carbon wire as an electrode, deposit analyses can be varied, simply by changing the granular magnetic flux. At present, four Magnecote fluxes are available covering build-up and hard-facing requirements.

HOW STOODY MAGNECOTE OPERATES

The Magnecote process is applicable to all present semi-automatic welding machines. It needs only the addition of a Stoody Magnecote Hopper for feeding the flux.

Welding current passing through the bare wire (electrode) develops a magnetic field. Flux granules within the hopper are magnetically attracted to the wire, forming a uniform coating. When the arc is broken and the wire ceases to feed, small permanent magnets in the tip dam the flow of flux.



Illustrating method of feeding wire through Magnecote hopper. The granular flux is picked up at the base of the wire guide just before it leaves the hopper.

THE 4 MAGNECOTE FLUXES

MAGNECOTE 301—A build-up material producing Hadfield manganese deposits.

MAGNECOTE 304—A machinable build-up material for use on carbon or low alloy steel equipment.

MAGNECOTE 305—A hard-facing alloy having high abrasion resistance and good impact strength.

MAGNECOTE 302—A hard-facing alloy having high impact strength and good abrasion resistance.

Welding time on this Hammermill Hammer was cut in half with Stoody Magnecote. It was first built up then hardfaced for maximum life.

MAGNECOTE PROCESS OFFERS MANY OTHER ADVANTAGES

Flux dams are unnecessary—all flux is consumed. There are no flux recovery or grinding problems. Since the shielded arc process is employed, the work is visible to the operator at all times. Welding is continuous—no stub end losses. Material costs are lower than for comparable manual electrodes. Appearance of deposits gives a good indication of weld quality. Deposits are remarkably uniform, sound and free from porosity.

Multiple passes are made with ease. Amperage ranges from 200 to 350.

UNUSUAL WELDING SPEED CUTS COSTS

Considerable field work has now been completed using Stoody Magnecote on production work. The following are typical of results obtained on CRUSHER ROLLS:

Manganese Shovel Track Pads are built up with Magnecote 301. Two finish passes of Magnecote 305 insure extra wear resistance. Probable service life—50% more than replacement parts.

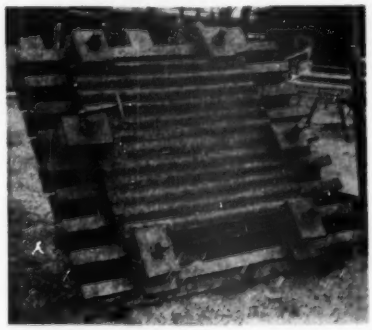
Case No. 1:

65 lbs. of Magnecote 302 were deposited in 5½ hrs. In comparison, using the two-rod filler method, 40 lbs. were deposited in 8 hrs.

Case No. 2:

On a 40" O.D. roll with a 22" face, 180 lbs. of Magnecote 301 were applied in 18 hours. The job was completed with a final pass of Coated Tube Stoodite. Total build-up: 1¼" on diameter.

On a conservative basis where a welder deposits 3 to 4 lbs. per hour by manual methods *he can now lay down from 8 to 12 lbs. per hour with Magnecote. Combined savings in labor and overhead easily amount to several dollars per hour.*



This Crusher Jaw has manganese rounds tack welded in place to form corrugations, then entire face is rebuilt with Magnecote 301. Final passes of Magnecote 302 extend service life as much as 2 to 1 over new jaws.

Stoody Magnecote excells on heavy equipment such as this Dredge Pump Casing where extensive buildups are required. Magnecote 301 restored size, Magnecote 302 provides an excellent final hard facing overlay.

Although best adapted to welding in down-hand position, the method is also applicable to inclined work by building a shelf and welding upwards.

Your Stoody dealer is now equipped to give you additional details and application help on Stoody Magnecote. Consult the yellow pages in your telephone book or write direct!

STOODY COMPANY

11941 EAST SLAUSON AVENUE • WHITTIER, CALIF.

NOW!!!
CESIUM RADIOGRAPHY SOURCES

33-Year Half Life...Very Low Cost...Increased Contrast...Lighter and Less Expensive Containers

Tracerlab has reduced prices of its Cesium-137 sources up to 70%, because the AEC has reduced its cost, we are now buying in quantity, and are encapsulating popular sized sources for stock. Cesium is being increasingly used for radiography because of its lower energy radiation (0.60 MEV), which makes it ideal for thin steel sections and less dense metals such as aluminum, because better contrast is obtained. Additional advantages are its long life and the use of lighter shipping containers. 1 Curie source (3/16" x 1/8" active dimensions) only $275.00.

Complete cost and delivery information on request.

Tracerlab
HIGH ST., BOSTON
WRIGHT AVE., RICHMOND, CAL.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND

AN AIR REDUCTION PRODUCT

FOR WELDING AND CUTTING...

IN THE RED DRUM

HIGHEST QUALITY

DUST-FREE

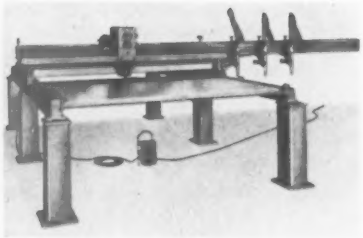
NATIONAL CARBIDE

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

National Carbide Company

GENERAL OFFICES: 60 EAST 42ND STREET, NEW YORK 17, N. Y.

A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED



Cutting machine

68 "STATOSEC" shape-cutting machine is a multiple torch-apparatus that is available in widths of 60, 80 and 100 in. Standard length is 144 in. Additional track for longer continuous travel can be obtained. Magnetic head is standard driving mechanism for production cutting. Single or multiple circles can be reproduced with automatic circle cutting attachment.

Optional equipment includes manual tracing head and an electronic tracer.

THE BURDETT OXYGEN CO.

* * *

Chippers' goggle

69 LENS-fogging is attacked in three ways in new "Model 900" chippers' goggle, according to manufacturer. Besides usual perforation in side shields, extra ventilation is provided through slots in lens-retaining rings and channels in lens seat area and through wide channels between retaining rings and cup walls.

Goggle is available in brown opaque, clear or green transparent thermoplastic cups with standard 50-mm safety lenses.

PENNSYLVANIA OPTICAL CO.

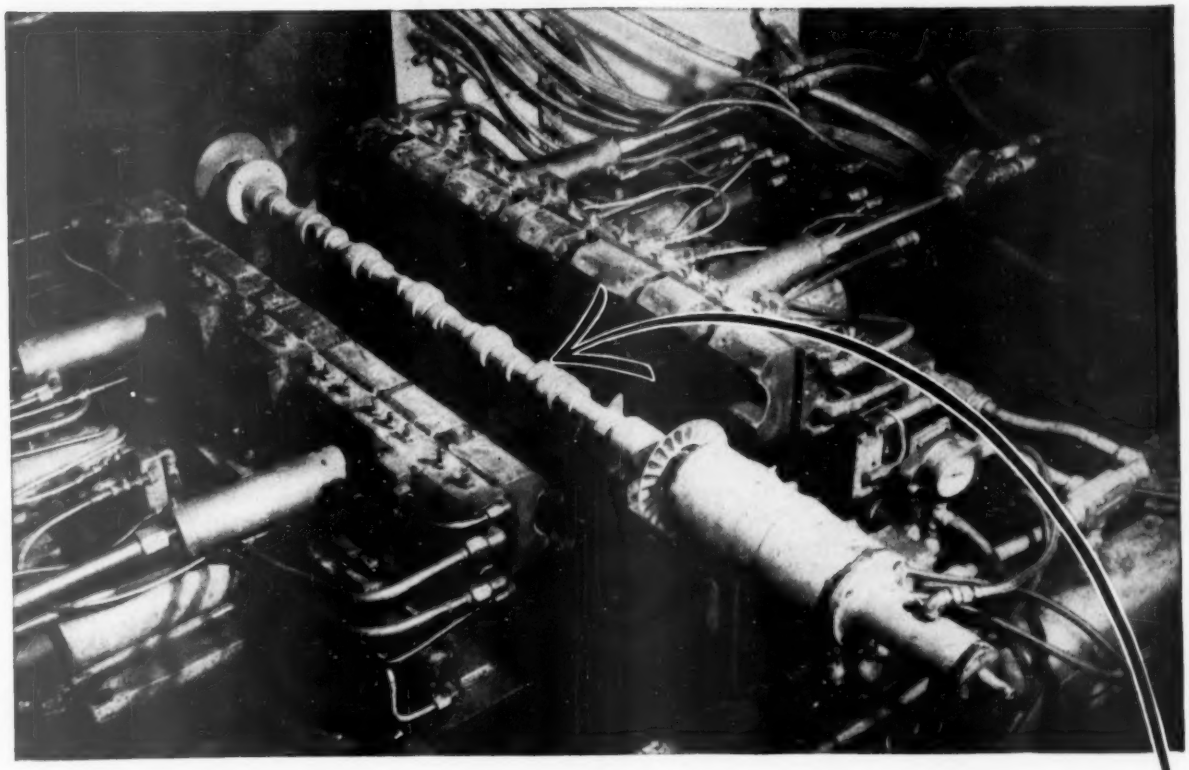
* * *

Mig filler wire

70 CHEMICALLY microfinished and electronically microspooled filler wire is for use in Mig (metal inert-gas) welding. Now available on expendable spools are aluminum, magnesium, stainless, titanium and other special alloy wires. Available in sizes from 0.015-in. diameter.

WELDROD CO., INC.

For more information use card on page 89



Automatic Flame-Hardening Boosts Production 300%

A cross-section view of this camshaft shows an even, uniform depth of the hardened surface.

Using an automatic oxy-acetylene flame-hardening machine, a leading manufacturer of trucks and marine equipment increased the production of flame-hardened gears, bearings, and camshafts 300 per cent. Parts are flame-hardened on as many as 22 different surfaces in fast, simple operations.

The flame-hardening process produces wear-resistant surfaces on large and small sections without heating the entire part . . . Distortion is at a minimum, and case depth is easily and accurately controlled. Flame-hardening is fast and relatively simple compared with other methods of hardening metal such as nitriding and carburizing. Low cost, portable flame-hardening equipment is available for the majority of applications.

Your local LINDE representative will be glad to show you how to produce machine parts with a tough, ductile interior and a hard, wear-resistant surface. Start saving now, call him for more information on flame-hardening.

LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
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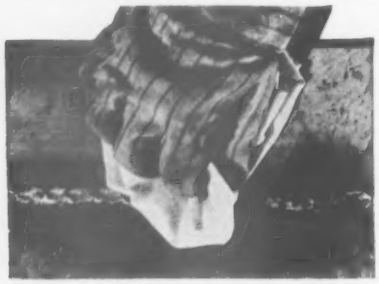
In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited, Toronto

Linde
Trade-Mark

"Linde" is a registered trade-mark of Union Carbide and Carbon Corporation.



cut weld cleaning time by 85%

Throw away your cold chisel and whisk off weld spatter with a dry rag! Protect-O-Metal spatter-proofing compounds make weld cleaning a breeze. Improve your welds at the same time — P-O-M compounds quiet the arc, improve fusion and electrode operation, prevent oxidation and annealing scale, cause no porosity. No smoke, odors, or fumes.

P-O-M No. 2. Non-inflammable, non-toxic, water-soluble paste. Inorganic. Thin before applying and start welding at once. $3.25 per gallon, f.o.b. Dayton.

P-O-M No. 8. Rust- and corrosion-resistant resin base compound. Comes ready to use. Safe for all metals. Good paint primer; permits outdoor storage of sub-assemblies. $3.30 per gallon, f.o.b. Dayton.

MONEY-BACK TRIAL OFFER

Order a trial gallon of each today for testing in your shop. We'll cancel the bill if you're not satisfied.

PROTECT-O-METAL

G. W. SMITH & SONS, INC. 5408 KEMP ROAD, DAYTON, O.

LIGHT DUTY TORCH CUTS 2½" STEEL

Cutting range of K-G's small, light *APL "Aircraft" Torch* is rated to 1" but tests show it can cut 2½" steel! Welding range is lightest gauge to ¼" plate . . . welding tips swaged or separable. Cost-cutting features: quick changeover from welding to cutting without a wrench . . . positive flashback resistance . . . all critical seating surfaces protected from damage, yet easily accessible for low cost maintenance. *Call your K-G Distributor, or send for 24-PAGE CATALOG. The K-G Equipment Co. (Inc.), Dept A, 1744 Lehigh St., Allentown, Pa.*

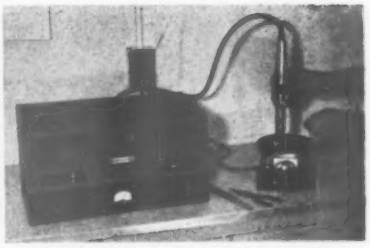
K-G APL Welding & Cutting COMBINATION

K·G

AP COMBINATION
Heavy Duty. Welding to 1"; cutting to 6".

APM COMBINATION
Medium Duty. Welding to ½"; cutting to 3".

There is a K-G Combination for Every Requirement



Fluxless soldering

71 ULTRASONIC equipment for fluxless soldering of aluminum, copper, brass, silver and magnesium includes generator, heating platen and hand-operated soldering head. Designated "Sonobond Model No. S-3-H-54-11," the unit is said to be particularly well adapted to hermetic sealing problems, electrical wire joints and other moderate size work. It will accommodate soldering tips varying in diameter from 3/16 to 5/16 in.

AEROPROJECTS, INC.

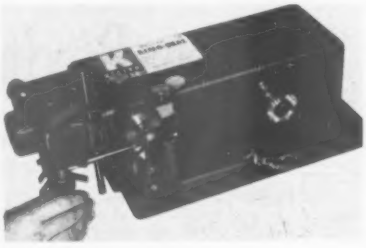
* * *

Projection welder

72 AIR-operated, press-type, low-impedance single-phase projection welder is designated "EP1." It can be supplied in throat depths from 12 to 30 in. and is available in 30, 50 and 75-kva at 50% duty cycle.

SCIAKY BROS., INC.

* * *



Ring former

73 COMPACT bench-type, air-operated tool is for forming rings of soft solder or brazing alloy directly onto part to be brazed. Operator places the part against the tool, and a slight pressure activates the ring-forming mechanism.

Rings are formed on the parts from a continuous roll of brazing wire or soft solder. As fast as a ring is formed, the wire is cut automatically, and another part can be placed in position to be ringed. Calibrated adjustments permit forming of rings from ¼ in. to 3 in. in diameter.

KELLER TOOL CO.

For more information use card on page 89

1 Coming up, an air conditioner! or a refrigerating machine. But first, the problem at a large manufacturing plant is how to weld this thick steel flange to the copper-nickel tube sheet. How to weld it soundly and faster! After jigging up and wire brushing to clean the weld area . . .

Sound welds in half the time

. . . now they use Inco "60" Monel Wire to join copper-nickel to steel

2 They solved this problem with a new welding procedure. And *a new welding material!* They changed to inert gas metal-arc, consumable electrode welding using spooled Inco "60" Monel Wire. What a difference! In welding speed, too! As a result . . .

3 Inspection shows a strong, sound, ductile weld. In fact, the manufacturer gets *sound welds in half the time.* Sound welds with deep penetration. Less metal used. Less waste. Less distortion. Cleaner, too. Add another . . .

4 Plus factor for the manufacturer: The weld made with "60" Monel Wire presents no corrosion problem from the brine circulated in this heat exchanger — because Monel® is outstanding in its ability to withstand corrosion by refrigerating brines.

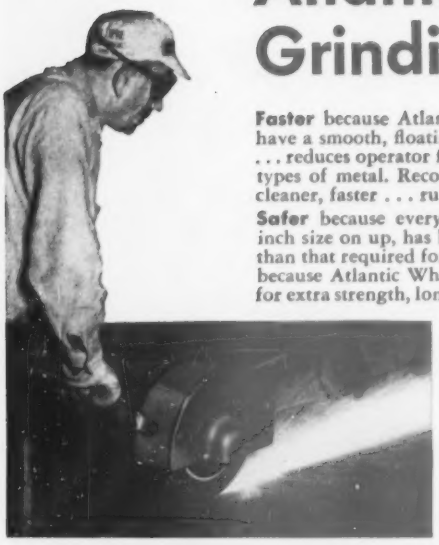
Do you have a problem in welding nickel alloys to other metals? Inco produces a complete line of electrodes and wires for welding nickel alloys to dissimilar metals. Helpful data on this subject is included in Inco Bulletin T-2. Write for a copy today.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

INCO **WELDING PRODUCTS**
Electrodes-Wires-Fluxes

Making WHEEL WORK
faster . . . safer . . . more economical

Atlantic Speed-Tested Grinding Wheels



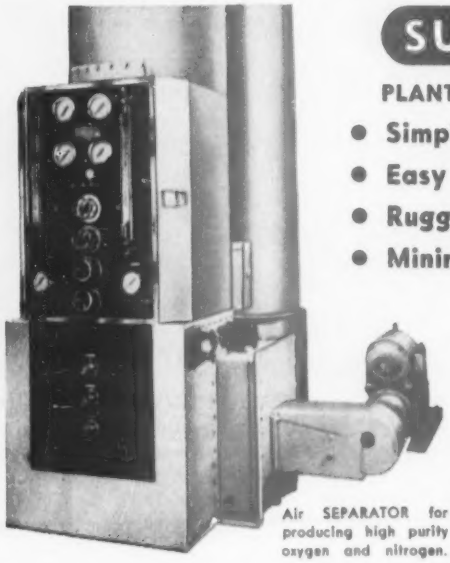
Faster because Atlantic Speed-Tested Grinding Wheels have a smooth, floating action that requires less pressure . . . reduces operator fatigue . . . speeds up grinding on all types of metal. Records prove that Atlantic Wheels cut cleaner, faster . . . run cooler on job after job.

Safer because every Atlantic Wheel sold, from the 2 inch size on up, has been test run at a 50% higher speed than that required for normal operating conditions. Safer because Atlantic Wheels feature a special Resinoid bond for extra strength, longer life under high operating speeds.

More Economical. Experienced operators find that Atlantic Grinding Wheels seldom have to be dressed . . . reduce clogging or glazing to a minimum . . . consistently lower replacement costs. Why not try them and see for yourself. Write now for complete details. Atlantic Abrasive Corp., 540 Pearl St., South Braintree 85, Massachusetts.

ATLANTIC ABRASIVE CORP.
South Braintree 85, Massachusetts

Oxygen-Nitrogen from Air



SUPAIRCO

PLANTS AND APPARATUS

- Simple to install
- Easy to operate
- Rugged construction
- Minimum maintenance

We have installations all over the world. Let us know your requirements. We will be glad to furnish detailed specifications and prices.

Air SEPARATOR for producing high purity oxygen and nitrogen.

SUPERIOR AIR PRODUCTS CO.
130 Malvern St. Newark, N. J., USA

Also manufacturers of plants for producing liquid oxygen—liquid nitrogen—liquid air also Storage and Transport Containers for all liquefied gases.

Temperature indicator

74 "TEMPILAQ" for 425 F and 475 F has been added to this firm's line of temperature-indicating materials. It is now available in the range of 113 to 400 F in 12½-deg intervals, in the 400-500 F range in 25-deg steps, and in the 550-2,000 F range in 50-deg intervals. Each is said to indicate its specific temperature rating with an accuracy of plus or minus 1%.

"Tempilaq" consists of materials of calibrated melting points suspended in an inert, volatile, nonflammable vehicle. On application, it dries quickly, leaving a mat opaque coating that liquefies when the specified temperature is reached.

TEMPIL CORP.

* * *

Automatic welder

75 REPORTED in a recent issue of *Raytheon News*, a new automatic welding machine is said to eliminate the drudgery of welding electrical condensers by hand. One of this firm's "Weldpower" welders is used in conjunction with the machine, which is said to cut wire leads and weld them to ends of condensers at rate of 2,000 to 6,000 per hour.

RAYTHEON MFG. CO.

* * *

Spot-welder head

76 PRECISION spot-welder head is especially designed for welding delicate and small parts in ferrous, non-ferrous or dissimilar metals. "Model 4" head is for use with miniature parts from ⅛ in. to 0.0005 in. combined thickness. Weight of moving parts has been reduced to less than 4 oz. Welding pressure can be adjusted from 6 oz to 15 lb. Ample space for mounting of fixtures is provided.

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Why it pays to specify *The Leading Brand*

YOU SAVE three important ways when you specify TUBE-TURN Welding Fitting and Flanges. (1) You get the most advanced products available . . . assured by Tube Turns' pioneering research. (2) You get the exact fitting and flange for *your* problem promptly because Tube Turns has the world's most complete line . . . available nearby. (3) You get piping ideas through the outstanding Engineering Service and how-to-do-it information of Tube Turns.

These money-saving extras are yours when you specify "TUBE-TURN". Call your nearby Tube Turns' Distributor.

The Leading Manufacturer of Welding Fittings and Flanges

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A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Chicago • Denver • Los Angeles
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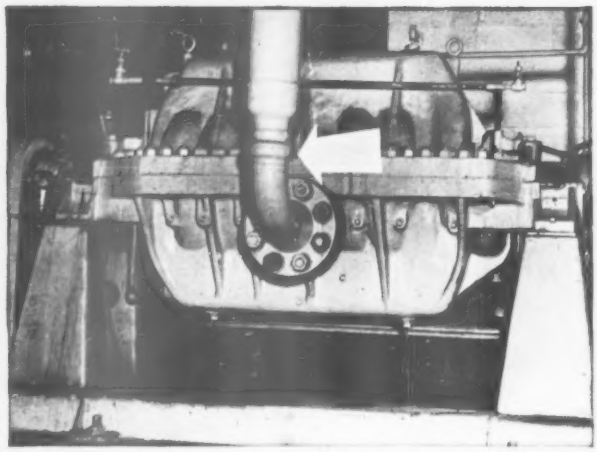
TUBE TURNS'
Engineering Service
helps save $50,000

A LARGE PROCESSOR had a problem of retubing seven large cooling units, formerly fabricated from copper tubing and fittings. Thin-walled aluminum was considered as a replacement; however, there were no satisfactory methods for fabricating the metal.

Tube Turns' Engineering Service Division, working with Alcoa, came up with the solution. Special TUBE-TURN Elbows and a new brazing technique were developed and the problem was solved. Total saving by customer was $50,000. This engineering service is one of the extras you get when you do business with the leader . . . Tube Turns.

THE JOB. Brazing TUBE-TURN Aluminum Returns to aluminum tubing for cooling coils.



NEW HYDRAULIC COUPLING. This unique new TUBE-TURN Coupling for hydraulic piping eliminates weld scale and protrusions at joints, protects pumps and other precision equipment for lowest-cost operation. You are sure to get the latest cost-saving developments in fittings and flanges when you specify "TUBE-TURN".

YOU GET COMPLETE SERVICE. Your nearby Tube Turns' Distributor gives you the *exact* answer to your specific piping problem from the world's most complete line of welding fittings and flanges. It includes more than 4000 items . . . in all piping materials, schedules and sizes. This service is backed up by Tube Turns' engineering assistance.

TUBE TURNS, Dept. N-6
224 East Broadway • Louisville 1, Kentucky

Please send free copy of booklet, "Allowable Working Pressures".

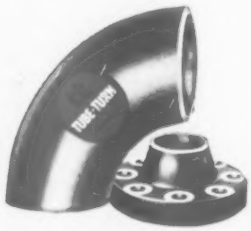
Company Name _____

Company Address _____

City _____ *Zone* _____ *State* _____

Your Name _____

Position _____



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"TUBE-TURN" and "TUBE-TURN" Reg. U.S. Pat. Off

TUBE TURNS

LOUISVILLE 1, KENTUCKY

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

for high speed welding of hard-to-weld steels

Speedex-LH

the new MUREX® low hydrogen-contact electrode

Speedex–LH combines all the advantages of a low hydrogen electrode with those of a high speed contact electrode. It yields deposits extremely low in hydrogen content. At the same time, its heavy coating, containing powdered iron, provides deposition rates up to 60% faster than those obtained with regular low hydrogen electrodes.

Speedex–LH can speed your welding–save you time and money on many types of work, including:

1. *Welding of hardenable steels without preheat and without danger of underbead cracking.*
2. *Welding high sulphur steels without porosity.*
3. *Welding of cold rolled steels which tend to produce pin-holing when welded with conventional electrodes.*
4. *Welding low alloy or mild steels without cracking where stress relieving normally would be employed, but is not feasible.*

Ask to have Speedex–LH demonstrated. Contact your welding distributor or nearest M&T representative.

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CONSULTING · DESIGNING · RESEARCH

O'FALLON 5, ILLINOIS

NEW PRODUCT BRIEFS

77 **"Rustripper"** is designed for alkaline de-rusting of precision parts where dimensional change and acid embrittlement must be avoided. OAKITE PRODUCTS, INC.

* * *

78 **Rotating** selenium rectifier is mounted on same shaft with alternator field and a-c exciter, eliminating disadvantages of a commutator and slip rings in d-c generators, according to manufacturer. INTERNATIONAL RECTIFIER CORP.

* * *

79 **Contact** wheel, "TF-54," is said to combine aggressiveness with softness and conformability. It was developed for coated-abrasive belt polishing and finishing by Minnesota Mining and Mfg. Co. and CHICAGO RUBBER CO.

* * *

80 **Remote**-controlled valve is four-way, base-mounted, pressure-operated model adaptable to an almost limitless number of industrial applications, manufacturer claims. ROSS OPERATING VALVE CO.

* * *

81 **Air** motor is designed to combine in one compact unit a cylinder, a four-way valve and a wide variety of valve controls. Available in bores of 1½, 2 or 3 in., with any desired stroke. LEHIGH FOUNDRIES, INC.

* * *

82 **All**-purpose truck converts to hand truck, platform truck or a heavy-duty dolly. TECHTMANN INDUSTRIES.

* * *

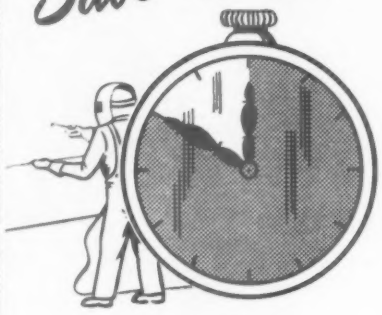
83 **Large**-volume fan, available with direct or vee-belt drive, is claimed to be compactly designed for easy installation and quiet performance. Housings and bases on these "MD" fans are made from extra-heavy sheet steel with continuous welded seams. CHICAGO BLOWER CORP.

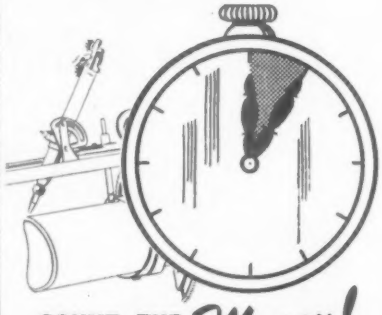
* * *

84 **Improved** performance and unusually large capacity-to-size ratio are features claimed for new "Fluid Power" cylinders of the "750" series. HANNA ENGINEERING WORKS.

For more information use card on page 89

Save THE TIME...





COUNT THE Money!

90% TIME SAVING ON ALL PIPE SHAPE-CUTTING

Reports from welders all over the country back up the claim that with the H & M Shape-Cutter and Beveler you can save at least 90% of the time spent hand-cutting Ells, Tees, Y's, Saddles, and other irregular shapes. Mr. Welder, THAT'S A SAVING WORTH LOOKING INTO!! Every minute you can save means more profit dollars in your pocket. It also means that you're in a lot better position when the seals are broken on those pipe fabrication competitive bids. Here's how the unique H & M works: (a) First you mount the desired pattern on your H & M Cutter; (b) Next, slip the split, horseshoe-shaped gear over the pipe; (c) Snap the machine in place with the spring-tension chain fasteners; (d) Light and adjust the torch; (e) Give the hand-crank a few turns — that's all there is to it. For the full story on the H & M

WRITE FOR THE FREE FOLDER "MORE PROFIT DOLLARS IN PIPE FABRICATION"

H&M PIPE BEVELING MACHINE CO.

Trade Mark Reg. U.S. Pat. Off.

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Here is a steel with 90,000 psi. yield strength that you can weld or flame-cut easily

USS Carilloy T-1 Steel

gives you 100% joint efficiency without pre- or post-heating... provides amazing sub-zero toughness as well as high temperature strength

NOW, with USS Carilloy T-1 Steel, you can flame-cut or weld very high strength parts either in the shop or the field *without* the need for heat treating equipment. In addition to its great strength, this new quenched and tempered alloy steel has unusual resistance to impact abrasion.

The secret to the excellent weldability of T-1 Steel—and its durability under high impact stresses—is its amazing toughness even at temperatures far below zero. In field tests of non-stress relieved, *welded* pressure vessels, T-1 Plate Steel withstood impact wallops of 2,000,000 ft. lbs. at temperatures as low as 38° F. below zero. Steels customarily used for pressure vessels—even if stress relieved—could not take that kind of punishment. But the T-1 Steel and every weld in the vessels remained sound. The welds, made by manual arc welding with E 12015 low hydrogen coated electrodes, developed the full strength of the parent metal. No special techniques were used.

How this new steel cuts fabricating costs

T-1 Steel cuts costs in several ways. You can reduce the thickness and weight of heavily stressed parts by taking advantage in design of its very high yield strength of 90,000 psi. Thinner sections mean less welding time, less welding rod required.

You can make these welds without the lost time and extra expense of pre- or post-heating. And with no need for heat treating equipment you can fabricate or make repairs either in the shop or the field—wherever it is more convenient and less costly.

You can often take advantage of T-1's high strength to build larger size pressure vessels and storage tanks. As a result, you can build *one* vessel big enough to replace *several* of present design. Or you can build the *same* storage capacity with less steel, less welding, less cost.

Where to use T-1

Carilloy T-1 Steel is now being used to cut costs, increase service life, reduce size and weight of pressure vessels, power shovels, mining cars, and rotating machines. It is being considered seriously for use in high pressure pipe, bridges, and penstocks. It is applicable to a wide range of tough jobs where the stress is primarily tensile, where great toughness or high temperature strength is needed—in fact, everywhere that you want a very strong steel that can be welded easily.

Write for complete information. United States Steel, Room 4577, 525 William Penn Place, Pittsburgh 30, Pa.

UNITED STATES STEEL CORPORATION, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
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UNITED STATES STEEL EXPORT COMPANY, NEW YORK

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New **One-Package**

DryRod Electrode Oven

Gives ON-THE-JOB Protection for Low-Hydrogen and Stainless Steel Rods!

NOW YOU CAN HAVE full protection on scattered, isolated jobs for your low hydrogen, stainless steel or other special alloy electrodes . . . with new bantam-size Model 10 DryRod Electrode Oven! Lightweight, Model 10 goes everywhere operator can work . . . holds full 10-lb. package of 14" rods . . . protects against moisture absorption with even, continuous flow of heat. Saves on costly rejects, reworks, scrap loss just like larger DryRod Models—Yet costs less than $50, fully wired, 110-volt AC! Ideal for large, diversified plants and shipyards . . . oil fields and construction jobs . . . installation on mobile service units . . . or as regular unit in smaller shops. See your dealer, or write for full information TODAY!

DryRod—Trademark—X-DR-15

Portable Unit Saves 4 Ways Like Other Models:

1 Store sealed cartons in warm, dry place.

2 Place unpackaged electrodes in DryRod Oven and withdraw as needed.

3 Locate DryRod as close to welding operations as possible.

4 For flexible, large-volume storage, stack ovens with compact DryRod Stands.

DryRod DIVISION OF Phoenix Products Co.
4215 N. 27TH ST. MILWAUKEE 16, WIS.

85 **Clad** aluminum tubing is new type of irrigation pipe designed for use where water is highly corrosive. Made possible by continuous electrically welded method, it is available in diameters ranging from 2 through 5 in. and in 40-ft lengths. KAISER ALUMINUM & CHEMICAL CORP.

* * *

86 **Typical** applications of new "Multiple-Sequence Megacycle Preset Interval Generator" include control of radiographic units and destructive-testing facilities. POTTER INSTRUMENT CO., INC.

* * *

87 **Featuring** built-in brake, a new line of motors is available in range of sizes from ¾ to 30 hp. HARNISCHFEGER CORP.

* * *

88 **High**-capacity mechanical pressure gage measures compressive forces from zero to 10,000 lb. Available in ten ranges. W. C. DILLON & CO., INC.

* * *

89 **Chemical**-cartridge respirator with an "All-Vision" facepiece is said to offer new safety with comfort and convenience. It protects against fumes, smokes, dusts, organic vapors, etc. MINE SAFETY APPLIANCES CO.

* * *

90 **Spray**-type metal cleaner combines solvent, wetting agent and alkaline as a multiphase cleaner. "Vantrol 5618" is claimed to be especially effective on steel. VAN STRAATEN CHEMICAL CO.

* * *

91 **Dual**-purpose metal-cutting band saw needs no tools to be changed from horizontal to vertical service. WELLS MFG. CORP.

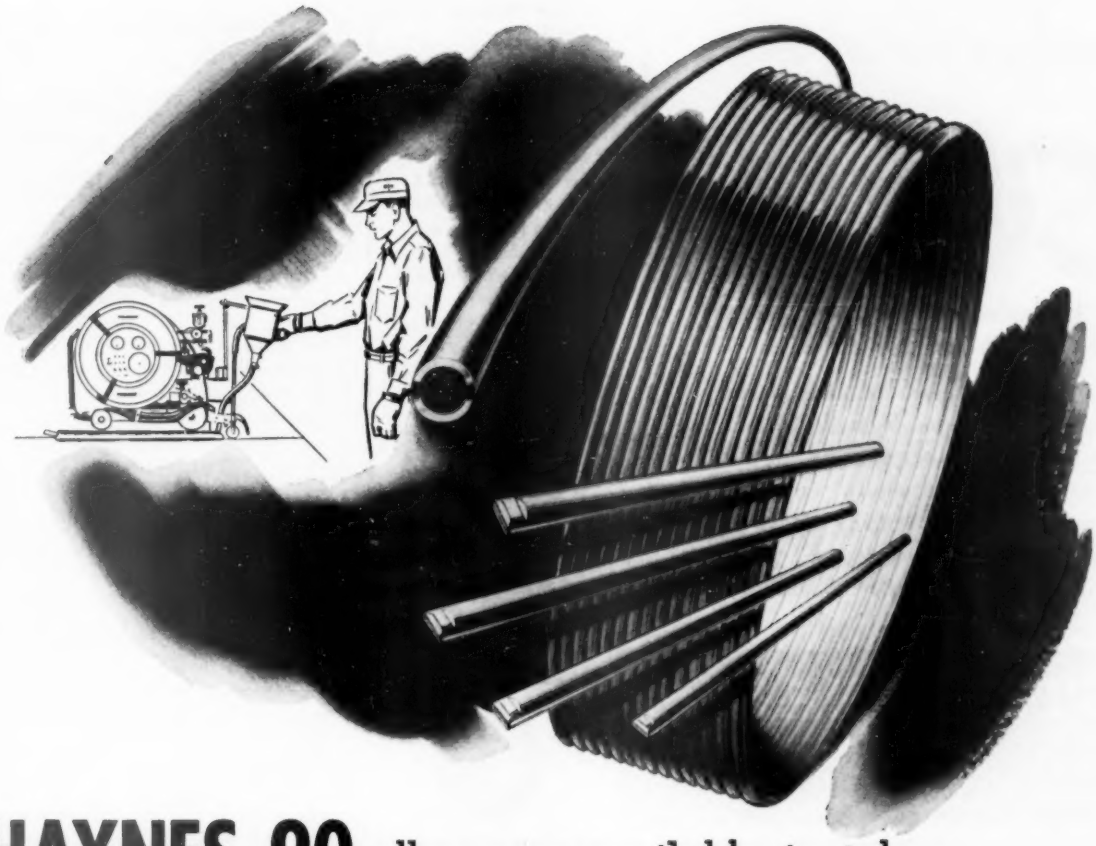
* * *

92 **Designed** primarily to hold irregularly shaped objects. "Model B Prestoflex Varijaw" speed vise can be used as a variable jig or fixture setup or an assembly clamp. THE CUSTANITE CORP.

* * *

93 **Wide**-strip electronic recorder measures and records both current and voltage simultaneously on one chart. The "Dynamaster Electronic Potentiometer" is said to have exceptionally fast response time. THE BRISTOL CO.

For more information use card on page 89



HAYNES 90 alloy now available in tubes and at a MUCH LOWER PRICE

TRADE-MARK

Now you can save even more by hard-facing wearing-parts with HAYNES 90 alloy. This is because HAYNES 90 costs so much less in this new economical tube form. These new tube rods produce sound, uniform deposits that won't crumble or flake off at temperatures up to 1000°F. They provide the same high abrasion, impact, and corrosion resistance—the same dependable protection for your equipment that HAYNES 90 brought to you as a cast rod—and at a much lower price.

For manual hard-facing, HAYNES 90 tube rod comes in convenient 14-in. lengths for easy application with standard metallic-arc welding equipment. For rapid coating of large parts, HAYNES 90 also comes in coils for mechanized hard-facing by the submerged-arc, inert gas, and open-arc methods.

HAYNES 93, HASCROME, and HAYSTELLITE alloys are also available in this economical tube rod form. HAYNES 93 iron-base rod is noted for high abrasion and corrosion resistance . . . HASCROME iron-base rod for high impact resistance . . . and HAYSTELLITE tungsten carbide rod is tops for resistance to severe abrasion.

For more information about these new, inexpensive tube rods and coils, along with other HAYNES long-wearing hard-facing products, contact your nearest Haynes Stellite Company office today.

"Haynes," "Hascrome," and "Haystellite," are registered trade-marks of Union Carbide and Carbon Corporation.

HAYNES TRADE-MARK ALLOYS

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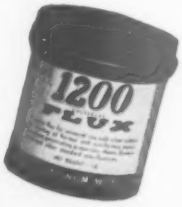
Silver Brazing Alloy preforms for Production Brazing. Rings, Stamped or Coined Washers and Wire Forms

All inquiries given immediate attention and shipments made on short notice. Technical service men are available to assist you in proper joint design. Silvaloy brazing alloys also available in wire, strip, and powder from stocks in six branch warehouses.

1200 FLUX

Use when silver brazing Brass, Bronze, Copper, Nickel-Silver, Steel, Stainless Steel, Monel, Nickel, Inconel and other Nickel alloys. Furnished in ½ lb., 1 lb., 5 lb., 30 lb., and 65 lb. containers.



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LAPEER CLAMPS BOOST TV TUBE PRODUCTION 15-20% AT RCA

Operator placing a tube in position. Note the Lapeer clamps.

At Radio Corporation of America, Lapeer special kinescope clamps are paying off in stepped up production in applying the phosphor to the faces of TV picture tubes. Gains from 15 to 20% have been registered.

Boosted output is obtained through the compact design of Lapeer clamps—permitting closer spacing and the installation of more fixtures on the traveling belts used in the operation.

Because the coating on tube faces must dry evenly, without ripples, it is important, too, that there be no vibration during clamping. Easy to operate, Lapeer clamps overcome this hazard. It's probable that Lapeer experience can help solve your clamping problems, too. Write for catalog—today.

Sales offices in principal cities—Teletype DE 49

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CANADIAN DIVISION • HIGGINSON ENGR., HAMILTON, ONTARIO

Letters should be addressed to: The Editor, WELDING ENGINEER, 330 W. 42nd St., New York 36, N. Y. No letter will be published unless signed, but your name will be withheld if you request it.

"Grass roots . . ."

Dear Sir:

We just recently began taking WELDING ENGINEER, and we are sure that we will enjoy it very much.

Last week, a gentleman asked us if we had the February issue of your magazine, which contained an article on flame straightening by Joe Holt ("Grass roots on stress control"). If at all possible, he would like to get a copy of this issue or article.

Very truly yours,
S. P. Jensen
Coos Bay Welders Supply Co.
Coos Bay, Ore.

More about "Pete"

Dear Sir:

One of our distributors called our attention to the story in your July issue, entitled "Pete does his bit," on the use of steel-hardening compounds such as ours.

We were very much interested in reading this story, and we want to congratulate you on being one of the first publication editors who have a real comprehension of the possibilities of the use of case-hardening compounds. We do not know what compound was used in this instance, but we have actually seen well drillers and gas drillers perform this same operation and do it more effectively. One told us that he obtained as much as a 50% increase in footage of the drill after hardening the point. . . .

We believe, as you state in your story, that hardfacing welding has its limitations as well as its uses, and it has been our understanding that it has not been too satisfactory at the end of a drill 500 or more feet down in the earth.

Very truly yours,
E. P. O'Donnell
Armor-Tuf Sales Corp.
New York City

(Continued on next page)

Dear Sir:

"Pete" in the July WELDING ENGINEER was really doing his "bit"—in the same way many drill bits are sharpened.

While I do not remember ever using a 3-in. pipe to support the hot end of a bit as he did, in years past I've used other things for support, just as he did the pipe. For the first working I used a 10- or 12-lb sledge, finishing with a 4- or 6-lb hand hammer. The bit was reheated to a uniform dark red for a few inches above the edge and plunged into water or brine, as the type of drill required.

When this work was done in the shop, we used the crane, but when in the field, we often used a rod or piece of 1-in. pipe about 3 ft long placed under the hot end of the bit, and two helpers lifted it from the fire while I handled the upper (thread) end. When laying it on the ground with the hot end resting on one of the wrenches or some other solid support, even a flat stone did nicely.

Yes, Pete was doing his bit, just as many of us "old timers" have done it.

I have forge welded new steel on these bits using a bootjack weld and doing most of the actual welding before removing from the fire. A helper holds a heavy dolly against the upper end while I drive the steel smooth down to size and sharpen and temper as above.

An "old timer"
E. O. Slater
Development Engineer
The Moore Co.
Marceline, Mo.

* * *

Query from Germany

I have read with much interest your article "Plain tips on plain steels" by Lester F. Spencer (March, 1954). In Germany, I have asked many welding experts: "What means E-6011?" and so on, but nobody could answer me. So I have translated the article for my own use, but what means "sulcoated electrodes?"

I believe that this article would be of great interest for the German weldors. Is it possible to print the article in the German publication *Schweissen und Schneiden?*

Very truly yours,
H. Petershagen
Chief Engineer
Handwerskammer Hamburg
Hamburg, Germany

We are glad to give you permission to reprint the article, providing Mr. Spencer and WELDING ENGINEER *are properly credited. A sulcoated electrode is a bare-wire electrode that has been slightly rusted before drawing.*

(Continued on page 80)

ANNOUNCING—

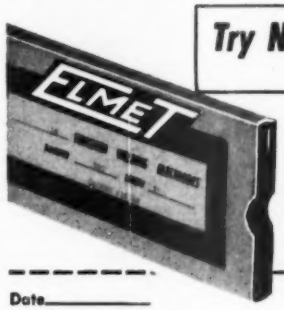
A NEW, *Improved* WELDING ELECTRODE by ELMET

—Pioneer Tungsten Producer

Here at last are pure and thoriated tungsten welding electrodes you can depend upon for uniformly superior performance. ELMET Efficiency Electrodes are manufactured by North American Philips, one of the pioneer tungsten producers with more than 20 years experience in this highly specialized field.

For purity, efficiency, reliability and perfect mechanical conditions, ELMET Tungsten Electrodes will meet your severest requirements. Their uniformity of properties, dimensions and characteristics prevent loss of time due to readjustments of equipment and voltage.

Rod diameters are held within specified diameters and limits of straightness, thus assuring good fit and uniform feed adjustment. Furnished in cleaned finish and centerless ground finish. Available in packages of 10 in all standard diameters from .040" to ¼" and from 3" to 18" in length. North American Philips Co., Inc., Elmet Division, Lewiston, Maine.



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Distributor Inquiries Invited

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Please send me ☐ *Free Folder and*

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(quantity, size, finish)

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safeguards
designed for comfort

POPULAR WIDE VISION "DEPENDON" SHIELD

This is the No. 320 Sellstrom "Dependon" Shield, only one of a large variety of different style shields for eye, face and forehead protection against practically all known industrial hazards. It has a wide range of uses including: grinding, chrome plating, degreasing tanks, paint and scale removing, etc. Also used as a protection against heat, sparks, hot liquids and acids. Consider these special features:

1. Changeable window is non-shatterable, expertly made from high quality clear acetate, highly resistant to heat, sparks and acid. Available in a variety of window sizes in either .020 or .040 clear or green acetate. Window is attached by five glove fasteners.
2. Adjustable headgear to fit any head. Fibre cap for forehead protection.
3. Equipped with a swivel which permits window adjustment to any position; accommodates even the largest prescription glasses. Extremely wide vision.
4. Genuine leather sweat band assures real comfort and guards against perspiration hazards. Increases work efficiency.

Most dealers carry these and other Sellstrom face shields in stock and can make immediate delivery.

If you have never used this "Dependon" Face Shield, we suggest that you write us for a sample shield on memo for test purposes. If after 30 days of actual use you do not find this shield thoroughly satisfactory, you can return it for full credit.

sellstrom
MANUFACTURING COMPANY

Eye and Face Safeguards Designed for Utmost Comfort

226 Hicks Road **Palatine, Illinois**

Welded houses

Dear Sir:

Please accept by thanks for the copy of WELDING ENGINEER, which you so kindly sent me.

The information it contained is interesting, and you may feel certain that I will look further into this type of home construction. It's the most advanced type of construction that we have read or heard about.

Thank you again for being so prompt in answering a request from a perfect stranger, who comes from a small town.

Gratefully yours,
Mrs. Emma B. Lemieux
Ipswich, Mass.

Dear Sir:

I am writing you for more information on the welded steel home as written up in your magazine and reported by the newspaper Daily Breeze here. . . .

Thanking you,
Mrs. C. Carner
Redondo Beach, Calif.

Dear Sir:

We wish to compliment you, Mr. L. R. Berry, Mr. Louis L. Katchen and Mr. Frank Ransome on the excellent article on use of light steel structural sections in Mr. Berry's new home appearing in the August, 1954, issue of WELDING ENGINEER.

The information is so clearly and completely presented in this article that we, being distributors of this product, would like copies to send to interested parties in our territory. If reproductions are available, will you please advise us as to how we may help to defray expense of same?

Yours very truly,
R. Walton McKissock
Ass't. Sales Manager
Guibert Steel Co.
Pittsburgh 4

Dear Sir:

A story in an Iowa newspaper mentioned a new type of house, called a "lifetime" home. Its main point of superiority seemed to lie in its use of steel. By the newspaper account, the story was evidently from your magazine, WELDING ENGINEER.

Can you give me the name of the producer of that kind of construction? Thanking you in advance, I am

Yours truly,
C. W. Wakeman
Friendship Haven
Ft. Dodge, Iowa

The above requests regarding "It's here! A welded steel home," an article appearing in August, have been answered.

ON THE JOB

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Any place—indoors or out—wherever clean, safe, dependable heat is needed on the job in a hurry . . . you can count on Silent Glow Portable Heat. Ideal for warming the men . . . heating the work area . . . temporary or emergency heat at all times.

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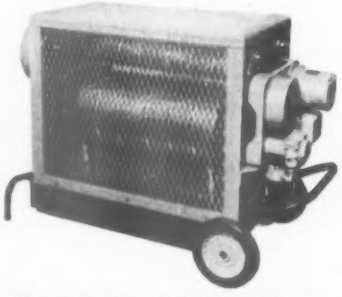

8 ***MODELS—A Portable Heater to meet every heating need . . . radiant or forced air . . . from 168,000 to 420,000 BTU per hour. Write for details today.***

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RADIANT HEAT
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BUILT TO TAKE IT

THE SILENT GLOW OIL BURNER CORP.
855 WINDSOR STREET, HARTFORD 1, CONNECTICUT

NEWS . . . . . *from page 6*

welding methods. The one more often used—arc welding, at 7 to 35 volts—connects wires with sheet-metal plates, with condensers and transformers, relays and resistors. Contact welding is used for hooking-up of wires only, using 4 to 7 volts.

The arc welding unit consists of a straight rod tipped with carbon. A cylinder is pushed over this rod, with enough play to prevent their touching anywhere. The rod and the cylinder, of about 1 cm (0.39 in.) in height, each receive separate current. An arc forms, between cylindrical end piece and tip of rod, melting all surrounding parts, with the exception of rod and cylinder, thus forming lasting connections.

For contact welding, a hand-grip unit with two "fingers" (carbon-tipped at the end) is mounted elastically in such a way that one of the fingers can be released from, or pressed toward, the other stationary finger. Between the two tips, metal objects become sufficiently molten to induce a liquid mixture of the two metals.

A special relay automatically disconnects flow of current, however, as soon as the material gets hot enough before melting. This preset temperature permits mixing of materials under pressure of the contact-welding "pliers."

While this method is claimed to make such connections almost breakproof, the article states that, in case of breakage, the two ends can be joined by a spiral of tin-covered copper wire and then soldered, or again welded by either method after a piece has been placed between as a bridge.

—*McGraw-Hill World News*

* * *

Tracerlab Inc. offers radiographic course

RADIOGRAPHIC techniques and safety procedures comprise a training course being offered by Tracerlab Inc. at its Boston, Mass., and Richmond, Calif., offices.

The 16-hour course includes three hours on properties of radiographic sources and their radiations and three hours instruction in the shielding of such sources. Other subjects include tolerance levels, the inverse-square law, monitoring equipment and radiographic techniques.

* * *

Renner moves to Milwaukee suburb

NEW address of Renner Mfg. Co. is 4810 N. 124th St., Butler, Wis., a suburb of Milwaukee.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND . . .

NEW

Aircosil

FOR ECONOMICAL SILVER BRAZING

AIRCOSIL – Airco's new and complete line of silver brazing alloys – is the economical answer to production line and occasional silver brazing jobs. Relatively low brazing temperature and excellent fluid properties mean fast brazing action, and savings in alloy and heat. AIRCOSIL is available in rod, wire, sheet, and other shapes.

AIRCOSIL 45: 45% silver plus copper, zinc, cadmium. 1125° F. to 1145° F. Most popular alloy available. Lowest temperature. Very free-flowing and very high strength.

AIRCOSIL 50: 50% silver plus copper, zinc, cadmium. 1160° F. to 1175° F. Government Grade IV. Very popular. High strength.

AIRCOSIL 35: 35% silver plus copper, zinc, cadmium. 1125° F. to 1295° F. Long plastic range. Ideal for making fillets. High strength, all metals.

AIRCOSIL 3: 50% silver plus copper, zinc, cadmium, 3% nickel. 1195° F. to 1270° F. The standard alloy for brazing carbide tool tips to steel shanks.

AIRCOSIL 15: 15% silver plus copper and phosphorous. 1185° F. to 1280° F. For copper, brass, and bronze. Self-fluxing on copper.

NEW AIRCO SILVER-BRAZING FLUX!

Available in paste form, AIRCOSIL Flux liquefies and becomes active at a slightly lower melting temperature than AIRCOSIL. Will not freeze or crystallize. Residue washes off in hot water. Available in ½, 1, and 5 lb. jars . . . also 30 and 65 lb. containers.

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Products of the divisions of Air Reduction Company, Incorporated include: **AIRCO** – industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO** – carbon dioxide, liquid-solid ("DRY-ICE") • **OHIO** – medical gases and hospital equipment • **NATIONAL CARBIDE** – pipeline acetylene and calcium carbide • **COLTON CHEMICAL COMPANY** – polyvinyl acetates, alcohols and other synthetic resins.

Q. Is it possible to be certain we are using the right filler metal for consumable electrode welding?

A. Yes. Alcoa's new I.G.* Electrode is available in such a wide range of alloys and sizes that there is a right one for every job.

Every production lot of Alcoa* I.G. Electrode is test welded and the welds X-rayed for soundness. Each 10-lb spool is individually packed to maintain the super-smooth finish to assure soundness of weld and smoothness of feed. Each of three alloys, 1100, 4043 and 5154 (formerly 2S, 43S and A54S), is available in six diameters. There is no better electrode.

*inert gas

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

A new, 176-page text, *Welding Alcoa Aluminum*, has just been released by Alcoa. It covers every phase of welding in complete detail. For a free copy, fill in and mail the coupon.

ALUMINUM COMPANY OF AMERICA
929-M Alcoa Bldg.
Pittsburgh 19, Pa.

Gentlemen: Please send book, *Welding Alcoa Aluminum*.

Name_____

Company_____

Title_____

Address_____ City_____ State_____

Q. Where is Alcoa's new I.G. Electrode available?

A. Contact your nearest Alcoa sales office, or, for immediate delivery, call one of the Alcoa Distributors listed below. He carries a complete range of alloys and sizes, and you'll find him well qualified to work with your welding experts.

ALBANY, N. Y.
†Eastern Brace-Mueller-Huntley, Inc.

ATLANTA, GA.
†J. M. Tull Metal & Supply Co., Inc.

BALTIMORE, MD.
Whitehead Metal Products Co., Inc.

BIRMINGHAM, ALA.
†Hinkle Supply Co.

BOISE, IDAHO
Pacific Metal Co.

BUFFALO, N. Y.
Brace-Mueller-Huntley, Inc.
Whitehead Metal Products Co., Inc.

CAMBRIDGE, MASS.
Whitehead Metal Products Co., Inc.

CHARLOTTE, N. C.
Edgcomb Steel Co.

CHICAGO, ILL.
†Central Steel & Wire Company
†Steel Sales Corporation
Corey Steel Co.

CINCINNATI, OHIO
Williams & Co., Inc.

CLEVELAND, OHIO
†The Hamilton Steel Co.
Williams & Co., Inc.

COLUMBUS, OHIO
Williams & Co., Inc.

DALLAS, TEXAS
Metal Goods Corp.

DENVER, COLO.
Marsh Steel Corp.
Metal Goods Corp.

DETROIT, MICH.
Central Steel & Wire Co.
Steel Sales Co. of Mich.

HARRISON, N. J.
Whitehead Metal Products Co., Inc.

HOUSTON, TEXAS
Metal Goods Corp.

INDIANAPOLIS, IND.
Steel Sales Co. of Indiana, Inc.

JACKSONVILLE, FLA.
Florida Metals, Inc.

KANSAS CITY, NORTH, MO.
†Marsh Steel Corp.
Metal Goods Corp.

LOS ANGELES, CALIF.
†Ducommun Metals & Supply Co.
Pacific Metals Co., Ltd.

LOUISVILLE, KY.
Williams & Co., Inc.

MIAMI, FLA.
Florida Metals, Inc.

MILFORD, CONN.
†Edgcomb Steel of New England, Inc.

MILWAUKEE, WIS.
Central Steel & Wire Co.
Steel Sales Co. of Wis.

MINNEAPOLIS, MINN.
Steel Sales Co. of Minnesota

NASHUA, N. H.
Edgcomb Steel of New England, Inc.

NEW ORLEANS, LA.
Metal Goods Corp.

NEW YORK, N. Y.
†Whitehead Metal Products Co., Inc.

PHILADELPHIA, PA.
†Edgcomb Steel Co.
Whitehead Metal Products Co., Inc.

PITTSBURGH, PA.
‡Williams & Co., Inc.

PORTLAND, ORE.
†Pacific Metal Co.

ROCHESTER, N. Y.
Brace-Mueller-Huntley, Inc.

ST. LOUIS, MO.
†Metal Goods Corp.

SALT LAKE CITY, UTAH
Pacific Metals Co., Ltd.

SAN DIEGO, CALIF.
Ducommun Metals & Supply Co.

SAN FRANCISCO, CALIF.
†Pacific Metals Co., Ltd.

SEATTLE, WASH.
Pacific Metal Co.

SYRACUSE, N. Y.
†Brace-Mueller-Huntley, Inc.
Whitehead Metal Products Co., Inc.

TAMPA, FLA.
†Florida Metals, Inc.

TOLEDO, OHIO
Williams & Co., Inc.

TULSA, OKLA.
Metal Goods Corp.

YORK, PA.
Edgcomb Steel Co.

†Home Office

—Courtesy Linde Air Products Co.

Stationary "flexible" welder speeds pipe fabrication

A PORTABLE submerged-arc flexible welder has been made even more useful by adapting it to stationary welding of steel pipe and thereby greatly increasing welding production. This was accomplished with the aid of a simple, inexpensive holding fixture built by the Central Pipe Fabricating and Supply Co., Sharonsville, Ohio, for use in the company's fabrication of piping for industrial plants.

It required 45 minutes to complete a satisfactory weld on a pipe joint with the previous welding method. Adoption of the submerged-arc process has reduced this time to about 4 minutes on a similar joint.

Welding head of the machine is positioned on a small portable fixture, shown above. Turning one knob raises or lowers the unit to desired heights, another moves the head sideways, while another moves the head back or forward. A turning jig rotates the pipe joint below the head during welding. First, tack-welds are made on the joint, followed by a continuous three-pass butt weld. Welding head is set at a 7½-deg angle to the work. Welding speed is 15 to 20 ipm. Result: a clean, sound weld that requires no finishing operations.

* * *

Large head flame-cut

SHIPPING problem posed by biggest heads ever spun was solved by flame-cutting them in half. They were reassembled at Walsh Holyoke Fabricators Div., Continental Copper & Steel Industries, Inc., Holyoke, Mass. Measuring 21 ft 8½ in. in diameter, four of these heads were spun on Lukens Steel Co.'s 276-in. flanging machine at Coatesville, Pa. Of 1¼-in. steel, they were to be used just once—to test penstocks for the Littleton, N. H., hydroelectric development of Connecticut River Power Co.

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STAINLESS STEEL ELECTRODES . . .

highest quality for lowest welding costs

We know *this* about ARCALOY —Alloy Rods Company's experts work continuously to guarantee the all 'round reliability and cost-saving performance of these stainless steel electrodes.

Maintaining this reliability is a must with us. Arcaloy core wire must meet rigid standards. Coatings must be formulated with exacting care —must produce a slag that is easily and quickly removed. The entire production cycle is under closely controlled quality supervision. This alone produces Arcaloy electrodes that give uniformly excellent welding, day in and day out. This alone is your guarantee of highest quality for lowest welding costs.

Buy Arcaloy Stainless Steel Electrodes from your Alloy Rods Distributor today. They are available for all grades of chrome-nickel and straight chrome stainless steels with either AC-DC or lime coatings.

One of the many steps taken to guarantee the all 'round reliability of Arcaloy electrodes is pictured here. The inspection welder makes continuous checks for arc characteristics, slag removal and weld bead appearance.

OVEN FRESH! ARCALOY Electrodes are packaged in the familiar ALLOY RODS red-and-yellow hermetically sealed metal containers. Available in 1/16", 3/64", 3/32", 5/32", 3/16" and 1/4" diameters.

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ARCALOY Stainless Steel Electrodes
BRONZE-ARC Bronze Electrodes
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WEAR-ARC Hard-Facing Electrodes
WELD-ARC Low Hydrogen Electrodes
CUT-ARC Cutting Electrodes

no finer electrodes made . . . anywhere

Represented in Canada by: Canadian LIQUID AIR COMPANY, Limited BRANCHES, PLANTS, WAREHOUSES AND DEALERS, COAST TO COAST

Abrasive-wheel firm moves to Sycamore, Ill.

SANDUSKY Abrasive Wheel Co., recently acquired as a wholly owned subsidiary by Ideal Industries, Inc., has moved its operations to Sycamore, Ill., from Kalamazoo, Mich. All facilities for manufacture, development, sales and service of the company's "Sawco" products are now centralized at the Sycamore plant.

Primary reason for the move was to provide expanded research and manufacturing facilities and increased product development and quality control. Sales and service facilities will also be expanded, with Ideal Industries' representatives handling the complete "Sawco" line of abrasive products.

* * *

Announce new publication on blast-cleaning equipment

AMERICAN Wheelabrator & Equipment Corp., Mishawaka, Ind. recently published the first edition of "Wheelabrator Tips." The publication has been developed for the benefit of customers using the firm's airless blast-cleaning equipment. It is to be a continuing service, issued quarterly, according to the announcement.

The publication will be devoted to helpful hints and discussions on better operating methods and better maintenance for Wheelabrator machines.

* * *

British Welding Research group holds open house

METALLURGICAL laboratories of the British Welding Research Association held an open house Nov. 23-24 in London. Researches on both ferrous and non-ferrous alloys were displayed. These covered many welding processes, including the argon-arc, metal-arc and self-adjusting arc processes.

* * *

Welded bleachers

BLEACHERS of all-steel welded construction that can be folded away have been introduced by Institutional Products Division, The American Welding & Manufacturing Co., Warren, Ohio.

Welded pipeline in Alaska nears completion

ALTHOUGH it will not go into operation for nearly another year, work has been completed on the major portion of a 620-mile welded pipeline for the Corps of Engineers from waterfront Haines to interior Fairbanks in Alaska. The pipeline will provide the major supply of jet, aviation and diesel fuels for the military in Alaska.

In addition to the pipeline, the multimillion dollar project will include construction of a petroleum dock at Haines, pumping stations, storage and other facilities needed as support along the pipeline's lengthy route. The pipeline has been completed along its entire length, except for the installation of stream and road crossings, which are being carried out by smaller, specialized crews.

The $29,000,000-pipeline contract is held by a combine including Williams Brothers, Tulsa, Okla.; McLaughlin Construction Co., Great Falls, Mont.; and Marwell Construction Co., Vancouver, B. C. A ditching machine of special design was used to dig a trench for pipeline burial through 100 miles of frozen soil, after a 50-ft right-of-way had been cleared.

The arc was struck for the first welded joint at the pipeline's northern end on the outskirts of Fairbanks on April 19. A few days later, another pipeline crew began similar operations on the Canadian side of the Alaska-Yukon border, some 300 miles southeast of Fairbanks, and worked toward Haines.

* * *

Phelps sketches history of welding in IOMA talk

PAST, present and future of the welding industry were discussed by H. C. Phelps, associate editor of WELDING ENGINEER, in a talk delivered Nov. 1 before a meeting of the Independent Oxygen Manufacturers' Association at Edgewater Beach Hotel, Chicago.

To back up his predictions for the future, Mr. Phelps cited many examples of the past: not many years ago welding aluminum was difficult and not done on a commercial scale; inert-gas welding, brought out during World War II, has split up into two big branches and has brought about great strides in metal fabrication.

He said the future could bring an atomic welder, as was discussed in WELDING ENGINEER's editorial last month—"Welding of today and tomorrow." Mr. Phelps also told of the manufacturers' role in setting a good example to jobbers in the industry by speeding pick-up and delivery.

"If I were the boss, I'd order NICKEL-ARC for all cast iron welding"

No wonder the welder himself prefers Nickel-Arc electrodes for welding cast iron. Nickel-Arc has a low-penetrating, easy-to-control arc, with a smooth, steady metal transfer and good wash characteristics. And his Nickel-Arc welds are completely free of cracks or porosity.

But the boss has even *more* reasons for specifying Nickel-Arc. *Better machinability*, the result of the special core wire and coating of Nickel-Arc, cuts his machining cost, improves appearance. And the *confidence* of his welders in the finer performance of Nickel-Arc electrodes guarantees better workmanship on their part.

Standardize on Nickel-Arc, the electrode that is best for machineable welds in cast iron. Order Nickel-Arc from your nearby Alloy Rods Distributor or write the plant for information.

OVEN FRESH NICKEL-ARC Electrodes are packed in hermetically sealed metal containers in 3/16", 5/32", 1/8" and 5/32" diameters.

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More than 350 Eutectic District Engineers join in wishing you and yours a Merry Christmas. In sincere appreciation of the friendship of weldors around the world, we resolve to help you enjoy a successful and prosperous New Year. Eutectic Welding Alloys Corporation.

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BEST IN SERVICE

- From 10 cubic feet to 320 cubic feet capacity.
- Made to the high standards of ICC specifications.
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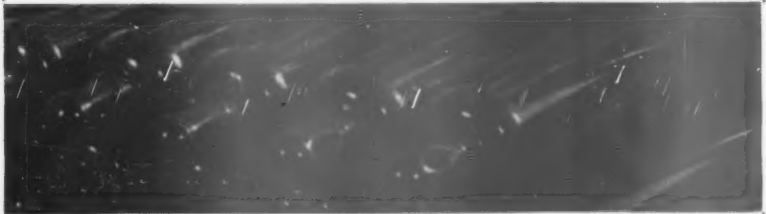

COYNE CYLINDER CO.
200 PAUL AVE. SAN FRANCISCO 24, CALIF.

Chicago distributor moves to suburb

NEW LENOX, Ill., a suburb south of Chicago, is now headquarters of Universal Welding Supply Co., which was formerly located on the Windy City's south side.

The new site provides 13,000 sq ft of working space, large shipping and receiving areas and ample parking and storage space. In addition, the firm has additional land for any future expansion.

The distributor firm's manufacturing division, OXO Welding Equipment Co., is also housed at the new headquarters.

* * *

Great use of welded-wire fabric in road building

MORE than 42% of the steel reported used in highways last year was reinforcing steel, two principal forms of which are welded-wire fabric and concrete-reinforcing bars. Steel consumption for the 29,000 miles of roadbuilding in 1953 was 1,250,000 tons. Consumption this year is expected to be about 1,500,000 tons, used in about 38,000 miles of roads.

The estimates were made by American Iron and Steel Institute on the basis of Bureau of Public Roads data.

Purpose of steel reinforcement in the form of fabric or bars is to control formation of cracks produced in hardened concrete by temperature changes and pounding of traffic. By holding cracks to a minimum, the steel prevents pavement from breaking up. Welded-wire fabric is made of wires crossed in a rectangular pattern and welded together at each crossing. It is produced in coils or mats.

* * *

Welds vertical pump

WELDOR places final bead on discharge nozzle of one of two huge vertical pumps destined for use by Lower Neches Valley Authority of Beaumont, Texas.

Stud welding saves more than $5,000

STUD welding helped the Soule Steel Co., San Francisco, save upwards of $5,000 on installation of sash on the protected upper floor of the Concourse Building, which leads from the central Terminal Building to various passenger loading gates at the new San Francisco Municipal Airport.

Charles Hoss, erection superintendent for Soule, subcontractor to Carl N. Swenson Co., general contractor, said that about 12,000 studs, each 5/16 by ¾ in., were fastened to the exterior of the steel column. This work, which involved enclosing approximately 4,000 linear ft of wall with a 9-ft high band of sash, was accomplished in approximately 50% of the time it would have required if through bolts had been used.

—Courtesy Nelson Stud Welding

* * *

Erico Products announces molding service

MOLDING service for the production of fiber-glass reinforced plastic parts has been announced by Erico Products, Inc., Cleveland. Molding compounds are formulated to suit requirements of each specific application. These materials are said to have high heat resistance and excellent physical and electrical insulating properties.

* * *

Distributor appointments

Ampco Metal, Inc., Weldrod Dept., Milwaukee: Arcway Equipment Co., Richmond, Va.; Hart Industrial Supply Co., Oklahoma City; Industrial Supply Co., Hazleton, Pa.

Buckeye Tools Corp., Dayton, Ohio: A. R. Ryan, New Orleans.

Hanna Engineering Works, Chicago: Barker Instrument & Machine Co., Charlotte, N. C., and Greenville, S. C.; Carl B. Pederson Co., Atlanta, Ga.

The Pandjiris Weldment Co., St. Louis: Acme Welding Supply Co., Houston; Arizona Welding Equipment Co., Phoenix; Aweco Supply Co., Tucson; Big Three Welding Equipment Co., Inc., Fort Worth; Industrial Specialties Co., Portland, Ore.; Industrial Supply Co., Inc., Salt Lake City; Johnson Supply Co., Denver; John H. Lease, Palo Alto, Calif.; Saginaw Welding Supply Co., Saginaw, Mich.; Service Supply Inc., Oklahoma City; Welding Engineering & Equipment Co., Syracuse; Welding Equipment Sales Co., Buffalo; Welders Supply Co., Seattle; Wiley Welding Supply Co., Los Angeles; Young-Welf Associates, Inc., Cleveland.

It's a cuttin' fool!

Light heavy-weight cutting torch It's a TRIPLE THREAT

Look what this NEW Smith's Cutting Torch gives you:

It is brand NEW. It ingeniously combines more operating advantages than any you have ever seen. Trade tests to date have been sensational. Check these facts and write us today.

★ Does the work of a heavy-duty torch . . . but you should see how LIGHT it is—and easy to handle!

Cuts anything from tomato cans to 14" steel (using proper tips). Yet it's light-weight and perfectly balanced. A brute for performance but easy on the operator. We put into this torch what you and other operators asked for.

★ Slip-In-Tips—no wrenches needed.

Just slip the tip in, spin the nut with your fingers and you're ready to go. How could anything be easier? Try it yourself and see.

★ 3 interchangeable controls—quick change from one to the other in less than 1 minute.

1. Over lever. 2. Trigger. 3. Under lever as shown above.

No matter what type of cutting jet control you prefer, you have it in this torch—and you can switch from one to the other any time you want. Adaptable to any personal likes or techniques. Reduces number of torches needed to accommodate all operators' requirements.

★ No slag . . . cuts clean.

The new Smith Tips with this torch give you clean, knife-line cuts with narrow kerf and almost complete absence of slag. Operator does not have to waste time cleaning up his cuts. Speeds up production. Want a demonstration?

Write today for complete details

SMITH WELDING EQUIPMENT CORPORATION

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Please send me more information on the time-saving and money-saving features of your new torch.

Name_____

Address_____

City_____ State_____

free literature..... USE CARD ON OPPOSITE PAGE

1 ELECTRODE HOLDERS — Empire Products, Inc. "Quick-disconnect" welding-electrode holders are depicted and their specifications given in two-page Bulletin No. 121. Holders are said to eliminate need for whips and whip ends or any mechanical or solder connection. They come in pug- or straight-nose types.

2 HARDFACING—Haynes Stellite Co. 40-page illustrated hardfacing manual tells what metals can be hardfaced, how to select right rod, which process to use, how to make the deposit and lists properties of hardfacing alloys and typical applications.

3 POSITIONER — Standard Portable Cord Co., Inc. 4-page illustrated pamphlet depicts applications of "Magic Positioner," a magnetic holding fixture for welding operations that consists of three 45-lb pull permanent magnets.

4 ALUMINUM ELECTRODES—Aladdin Rod & Flux Co. 4-page brochure describes and lists applications of aluminum gas-welding rods, brazing rods and arc-welding electrodes as well as spooled aluminum wire for Mig welding.

5 MOISTURE INDICATOR—Pilotrol Corp. Bulletin M.I. 100 includes diagrams and applications of "Little One Eye," a device for indicating moisture in gas lines.

6 TURNING ROLLS — Cayuga Machine & Fabricating Co., Inc. 2-page Bulletin 5303 illustrates and describes power and idler turning rolls and head and tail stocks for use in welding. The latter are devices designed for turning large structures and frames where a positioner would not be applicable.

7 PROJECTION WELDER — Ames Spot Welder Co., Inc. Specifications and illustrations are included in 2-page leaflet that describes firm's press-type projection welder (air-operated).

8 WELDOR'S VISE—Belmont Abrasives. Specifications and prices are listed in leaflet on "Grampus" vise, which is for use in setting channels, rounds, tubes, etc. at right angles for welding.

9 WELDING NEWS—Hobart Brothers Co. Vol. XI, No. 3 of firm's "Arc Welding News" is 24-page booklet that includes photographs and articles on welding from all over North America. Many of the articles feature time and money-saving applications.

10 A-C WELDER—The Lincoln Electric Co. Bulletin 1314 gives complete description and specifications of "Fleetwelder," a-c welder available in 300, 400 and 500-amp capacities. Welding is said to be made simpler because of easy current selection and self-starting arc.

11 HARDFACING CHART—Mir-O-Col Alloy Co., Inc. Comprehensive comparison chart lists various hardfacing rods and electrodes made by 29 different manufacturers. Gives applications, hardness ratings, abrasion and impact qualities.

12 RECTIFIER WELDER — General Electric Co. New rectifer-type welder, with current range of 20 to 375 amp and featuring quiet operation and low maintenance cost, is described in booklet GEC-1267.

13 PORTABLE SANDBLASTER—Victor Equipment Co. Descriptive literature gives specifications and prices of "Cyclone" portable sandblaster, which has trigger control. Manufacturer claims "Cyclone" will blast clean any surface with any abrasive material.

14 COPPER WELDING ALLOYS — Eutectic Welding Alloys Corp. 4-page illustrated news sheet lists five newly developed copper and copper-base welding alloys, which were listed as new products in WELDING ENGINEER for October.

15 WET BLASTING—Wet Blast Mfg. Co., Inc. 2-page brochure pictures and lists applications and advantages of wet blast equipment manufactured by this firm.

16 CUTTING MACHINES—The Burdett Oxygen Co. 4-page Bulletin 654 illustrates and explains operation of "Statosec" and "Corta 52" cutting machines. Both are multiple-torch units.

17 WELDING NEWS—Ampco Metal, Inc. Information on bronze welding is included in the third-quarter issue of "Ampco Welding News."

18 GOGGLES — American Industrial Safety Equipment Co. Leaflet pictures and describes "Eyegard Imperial" cover goggles for weldors and chippers.

19 TUNGSTEN — Sylvania Electric Products Inc. 20-page brochure is devoted to manufacture, properties and uses of tungsten. Colorful center spread depicts stages of production from ore to finished products, including electrodes.

20 CUTTING TORCH—Smith Welding Equipment Corp. Bulletin No. 250 contains information about new lightweight gas cutting torch. The three-in-one torch handle may be rotated to accommodate a cutting jet lever in either under- or over-handle position; a trigger can be installed in the former position.

21 WELDING DATA—U. S. Stoneware Co. Descriptive literature and test information is available on "Tygoweld," an organic welding material that comes in rod form and can be applied with moderate heats and little or no pressure. Welding technique does not require open flame or arc.

22 WELDING EQUIPMENT—Air Reduction Sales Co. Revised 20-page Catalog 2300 contains full description of manual, machine and automatic "Heliweld" equipment and accessories. Includes illustrations, charts, guide for selecting electrodes and gas nozzles, and specifications. Lists applications.

23 RESISTANCE WELDING — Sciaky Bros., Inc. Bulletin No. 324-2 describes new standard "SP 1" and "EP 1" series of air-operated, press-type, low-impedance, single-phase projection and spot welders.

24 WELDING HELMETS — Jackson Products, Inc. 2-page leaflet (Form H-3) pictures and describes new fiber-glass welding helmets, which come in fixed-front or lift-front types.

25 BRAZING — Handy & Harman. 4-page illustrated bulletin is No. 66 of "Low-Temperature Brazing News," which depicts brazing operations on radiator valves and other applications.

26 MAINTENANCE CLEANING — Oakite Products, Inc. "How-to-do-it" charts based on actual in-plant maintenance procedures are feature of 12-page "Plant Maintenance Cleaning Guide." Charts list recommended materials, methods of application, concentrations and temperatures for various cleaning operations.

27 MIG WELDING—Pacific Welding Alloys Mfg. Co. Available are price lists and descriptive literature on "Spoolalloy," a new welding wire for automatic Mig (metal inert-gas) welding processes. All oxides are claimed to be removed from wire.

28 GRINDING-WHEEL DATA — Cincinnati Milling Products Div. Brochure (PGS-303) describes complete line of grinding wheels for rough-grinding operations; especialy suited for welding work. Complete line is illustrated.

29 HYDRAULIC VALVES—Rivett Lathe & Grinder, Inc. Catalog 260 describes new line of sub-plate-mounted, solenoid-operated hydraulic valves. Includes diagrams.

30 TAPPING PIPE—Tube Turns. 2-page illustrated leaflet describes new full-encirclement saddle that improves "hot-tapping" of pipelines. Installation is depicted in photo series.

31 FUME COLLECTORS — Ruemelin Mfg. Co. 8-page Bulletin 100A is catalog depicting equipment manufactured by this firm, which includes welding-fume collectors, blast-cleaning equipment and dust filters.

32 BRAZING ALLOYS—United Wire & Supply Corp. 4-page bulletin (Form B531) describes and lists specifications of this firm's brazing alloys.

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs and Bulletins shown on facing page

Also information about

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Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

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NOT GOOD AFTER MARCH 1, 1955

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WELDING ENGINEER — A McGraw-Hill Publication

NOT GOOD AFTER MARCH 1, 1955

WELDING ENGINEER

Please send me without obligation further information about the following:

Getting all the information about all the significant new developments in welding every month is a tough . . .and time-consuming . . . job. To save your time, the editors of WELDING ENGINEER screen scores of new catalogs and bulletins each month and select only the ones they think will be of interest to you. These are summarized for your convenience on page 88. The companies issuing this material welcome your request for copies.

To save your time in making such requests, simply use one of the attached post cards.

For catalogs, bulletins and other Free Literature, simply write in on the post card the numbers which correspond to Free Literature offerings on page 88.

For New Product information, write in on the post card the numbers corresponding to the items beginning on page 50.

Welding Info-Aids will do the rest.

Please use one card only . . . so that this service may also be available to other men in your company who may read this same copy of WELDING ENGINEER.

IMPORTANT

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Illegible or incomplete addresses may keep you from receiving the information you desire.

Navy tells of plastic patch for emergency pipe repair

A NEW plastic patch that has partially solved the problem of emergency repair of ruptured or damaged piping aboard ship has been adopted by the U. S. Navy. The patch, said to have all the simplicity of a first-aid bandage, is easily applied and can put a damaged system back into operation in about 30 minutes.

So far, tests indicate these metallic plastic pipe patches should be used only on fresh or salt-water piping where pressure does not exceed 300 lb or where temperature is not above 200 F. Little skill is needed to apply the patch.

* * *

Diffraction school attracts more than 100 persons

SOMEWHAT more than 100 registrants from educational institutions, research organizations and many types of industrial establishments recently attended a course in X-ray diffraction at the Hotel Knickerbocker, Chicago, under sponsorship of North American Philips Co. Inc., Mount Vernon, N. Y. It was held the week preceding the Metal Show.

* * *

Electronics conference has record attendance

A RECORD attendance of 7,323 was recorded at the 10th annual National Electronics Conference which met Oct. 4 through 6 at the Sherman Hotel, Chicago.

The conference presented an 86-paper technical program and 158 booths of exhibits by manufacturers in the electronics field. The technical program included sessions on electronic circuits, electron tubes, electronic tube reliability and instrumentation.

* * *

Tig welding

"HAT" of this aluminum sealing cover for radar components is welded to flange in six minutes. Using mechanized Tig (tungsten inert-gas) welding, fabricators of this aircraft part have increased production 1,000%.

AT THE FRONTIERS OF PROGRESS YOU'LL FIND . . .

NEW

Aircosil

AIRCO'S COMPLETE LINE OF SILVER BRAZING ALLOYS

Here is Airco's brand new line of silver brazing alloys — AIRCOSIL — available in rod, wire, sheet, rings, and gaskets, as well as special forms and shapes . . . for economical, high-quality brazing of sheet metal and tubing. Standard AIRCOSIL types available, as well as special analyses, for joining ferrous, nonferrous, and dissimilar metals.

AIRCOSIL 45: 45% silver plus copper, zinc, cadmium. 1125° F. to 1145° F. Most popular alloy available. Lowest temperature. Very free-flowing and very high strength.

AIRCOSIL 50: 50% silver plus copper, zinc, cadmium. 1160° F. to 1175° F. Government Grade IV. Very popular. High strength.

AIRCOSIL 35: 35% silver plus copper, zinc, cadmium. 1125° F. to 1295° F. Long plastic range. Ideal for making fillets. High strength, all metals.

AIRCOSIL 3: 50% silver plus copper, zinc, cadmium, 3% nickel. 1195° F. to 1270° F. The standard alloy for brazing carbide tool tips to steel shanks.

AIRCOSIL 15: 15% silver plus copper and phosphorous. 1185° F. to 1280° F. For copper, brass, and bronze. Self-fluxing on copper.

NEW AIRCO SILVER-BRAZING FLUX!

Available in paste form, AIRCOSIL Flux liquefies and becomes active at a slightly lower melting temperature than AIRCOSIL. Will not freeze or crystallize. Residue washes off in hot water. Available in ½, 1, and 5 lb. jars . . . also 30 and 65 lb. containers.

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Products of the divisions of Air Reduction Company, Incorporated include: **AIRCO** — industrial gases, welding and cutting equipment, and acetylenic chemicals • **PURECO** — carbon dioxide, liquid-solid ("DRY-ICE") • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON CHEMICAL COMPANY** — polyvinyl acetates, alcohols and other synthetic resins.

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BRAZES 14 METALS...

Steel
Stainless Steel
Monel
Nickel
Copper
Brass
Bronze
Cast Iron
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Carbides
Tool Steel
Low Carbon Steel
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Manganese Steel

HAS THESE MANY INCOMPARABLE CHARACTERISTICS

Tensile Strength, 85,000 psi.
Shear Strength, 160,000 psi.
Elongation in 2", 12.0%
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Flows Like Silver Solder
Resists Wear 5 times Better Than Steel
Bonds at 1450 F
Takes Less Heat
Takes Less Preparation
Takes Less Cleaning
Finishes Jobs Faster

A LITTLE DOES A LOT MORE

No. 11 Costs Less Per Job
No. 11 Goes Further—Usually 3 times
No. 11 Saves Gases—Up To 50%
No. 11 Saves Time —Up To 60%
No. 11 Saves Dismantling
No. 11 Saves Reassembly

Comes Bare and Flux Coated
Sold by 700 All-State Distributors

SEND FOR Complete Application Instructions

ALL-STATE WELDING ALLOYS CO. INC.

WHITE PLAINS, N. Y.

FRED C. STOCKING has been appointed district manager for the West Coast area by Bay State Abrasive Products Co., Westboro, Mass.

* * *

A. T. MORTRUD has been named manager of a new district office in Cleveland opened by Harnischfeger Corp., Milwaukee. The new office, located in the NBC building, 815 Superior Ave., N.E., will handle sales of all "P&H" welders, electrodes, positioners and accessories as well as provide assistance with various welding problems.

* * *

Hobart Brothers Co., Troy, Ohio, recently announced appointments of the following three field representatives: MYRON A. KING is the new district representative for California. He is in charge of warehousing and distribution of Hobart arc-welding equipment, supplies and electrodes and has his headquarters in San Francisco. HAROLD SCRUTTON is direct factory representative in the Southeast territory. His duties include coöperating with distributor outlets, sales training and general promotion of sales of above products. BUELL NALLEY has taken over the Ohio-Indiana district for territorial development. He will have supervision over coöperative distributor operations in sales of welding products.

* * *

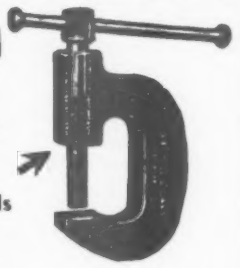
WALTER L. FLEISCHMANN, welding engineer, Knolls Atomic Power Laboratory, General Electric Co., Schenectady, N. Y., has been named to serve on the nuclear engineering committee of The American Society of Mechanical Engineers.

* * *

MAJ. GEN. GEORGE CRAIG, recently retired from the Army, has been appointed general manager of the National Safety Council, a newly created post.

"Red Head"

WELDING CLAMPS



- Designed for Welding
- No Threads To Damage

1. Case hardened threads are always protected from weld spatter and never exposed to damage in open or closed position.

2. The clamp body is cut from solid plate, thereby insuring extreme rigidity and giving great resistance to bending or twisting.

3. Heat treated chrome molybdenum alloy handle offers great resistance to bending.

23 stock sizes

CHICAGO BOILER COMPANY
1968 CLYBOURN AVENUE
CHICAGO 14, ILLINOIS

NOT ONLY BETTER IN *EVERY* WAY

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NEW HI-AMP

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Weld with Wagner

JOHN W. SPOOR, formerly with A. O. Smith Corp., Milwaukee, has joined Power Products Corp., Grafton, Wis., as general sales manager.

* * *

FRANK L. COOPER has been named treasurer of Crucible Steel Co. of America, succeeding JAMES F. PRINCE, who retired.

* * *

GLEN C. FLUMERFELT has been named regional manager by All-State Welding Alloys Co., White Plains, N. Y., for California, Nevada, Utah, Colorado, New Mexico, Arizona and Hawaii. He formerly headed the Pacific Northwest region. A member of the American Welding Society, Mr. Flumerfelt has been in the welding industry and construction field for 18 years.

* * *

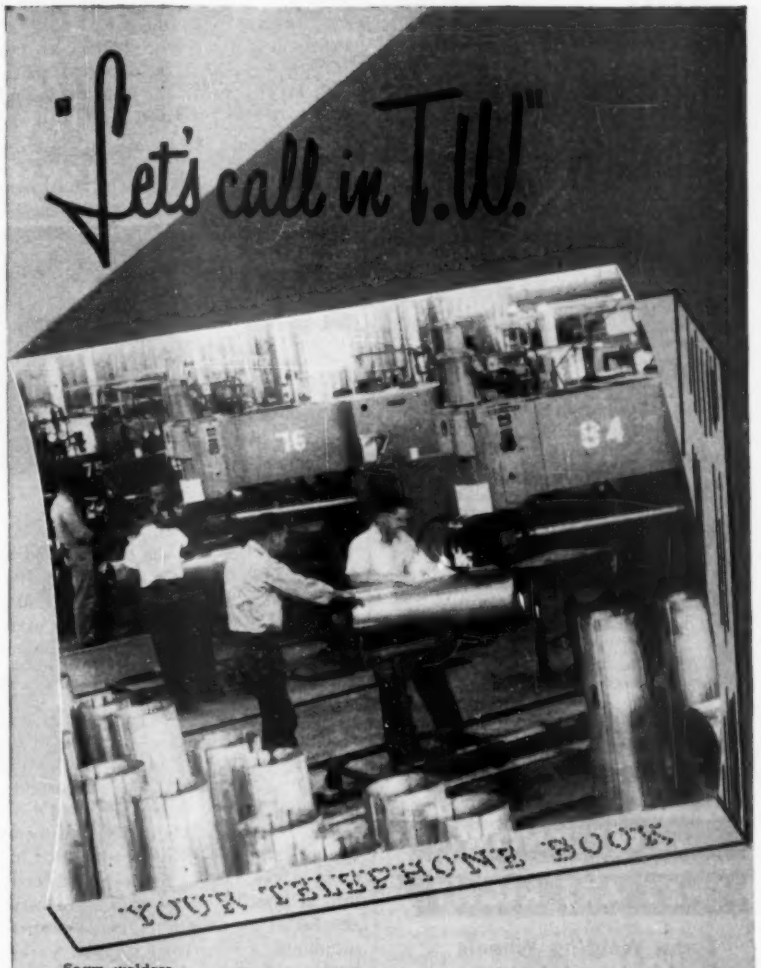
F. A. HENRY, formerly assistant to the general manager of A. O. Smith Corp., Milwaukee, has been named general manager of the firm's Pacific Coast works, Los Angeles. He succeeds A. W. SHUMAN, who resigned.

* * *

Following personnel appointments have been announced by Kaiser Aluminum & Chemical Sales, Inc., Oakland, Calif.: BYRON B. CLOW has been named manager of a new branch office in Louisville, Ky.; VERNON A. MCCHESNEY, manager, field engineering, with headquarters in Chicago; J. P. MORAN, building wire specialist in charge of the national sales program for aluminum building wire, with temporary headquarters in Philadelphia; DONALD P. SMITH, district service manager in Detroit; LEON A. SEEBER, branch manager in Minneapolis, succeeding LEROY S. YOUNG, now assistant district manager of the Detroit sales office; GEORGE M. ROUDEBUSH, Toledo branch representative in the Cleveland sales district; MARION L. PLOUSSARD, district service manager of the New York sales district.

* * *

DOUGLAS M. CONSIDINE has been appointed sales promotion and merchandising manager of P. R. Mallory & Co., Inc., Indianapolis. He formerly was with Minneapolis-Honeywell Regulator Co.



Seam welders welding aircraft parts

BUILDING RESISTANCE WELDERS INTO PRODUCTION LINES IS A TAYLOR-WINFIELD SPECIALTY

● How many welders do we need? What KVA for each operation? Press welders, projection welders, seam welders, butt welders? What type of operation? Why not call on the experience of Taylor-Winfield?

Taylor-Winfield can supply specific information about your production. For this practical help, "Call in T-W" and gain the benefit of facts, figures and experience with resistance welding.

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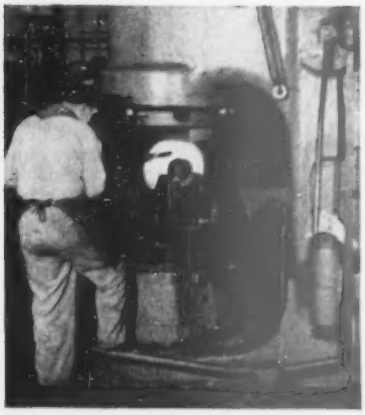
TAYLOR-WINFIELD
RESISTANCE WELDERS

THE TAYLOR-WINFIELD CORPORATION WARREN, OHIO

HIGH conductivity forgings & castings for all resistance welding needs..



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Seam Welding Wheels
Bushings • Knees
Shafts • Spindles • Etc.

Experience and technical skill identify WW ALLOYS. Long a leading reliable source of high conductivity, high strength forgings and castings —in rough or finished form—WW ALLOYS can meet any resistance welding requirement. And with the added advantage of WW's participation in Fansteel's continuous metallurgical research, you know you can count on WW for the job being right every time.

depend on W•W for metallurgical know-how and specialized experience

W545C

WW ALLOYS, INC.
Division of Fansteel Metallurgical Corporation
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A. J. FAUSEK and I. F. FAUSEK, Modern Engineering Co., St. Louis, recently had their life stories, as pertaining to their firm, depicted on the "St. Louis Story," a program broadcast over radio station KMOX.

• • •

HARDY G. REYNOLDS, JR., has been appointed representative for the Dakotas, Nebraska, Iowa, Wisconsin and Minnesota by Birdsell Mfg. Co., Inc., Palo Alto, Calif., manufacturer of arc and resistance - welding equipment.

• • •

DR. W. H. BRANDT has been named to head a new products engineering department formed by Westinghouse Electric Corp. He formerly was manager of special products development and joined the firm in 1936.

• • •

Following personnel changes were recently announced by U. S. Steel Corp.: BENNETT M. LIVEZEY has been assigned to the Chicago vice-president's office for special duties; he had been general superintendent of South Chicago works. OSCAR PEARSON succeeds him at South Chicago and is, in turn, succeeded as assistant general superintendent, Youngstown district works, by RALPH W. DICKSON. Mr. Dickson had been division superintendent, West mills, Gary steel works.

• • •

NICHOLAS G. JESSEN has been appointed assistant superintendent of the Barberton, Ohio, works of The Babcock & Wilcox Co.'s Boiler Division. He joined the firm in 1930, and in 1932 transferred to Barberton, where he has served as chemist, metallurgist, welding engineer and assistant director of the works laboratory. Mr. Jessen is a member of AWS, ASM and ASME.

• • •

ROBERT L. BELL has been appointed manager of manufacturing engineering by Carboloy Dept., General Electric Co., Detroit. He had been superintendent of metals.

• • •

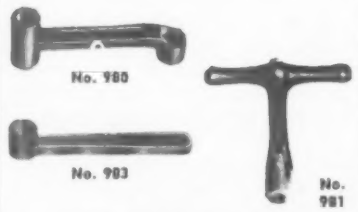
BRUCE W. SMITH has been appointed sales manager of the Instrument Division of Isotope Products Ltd., Oakville, Ont., Canada. He had been technical sales representative.

BUY SELL USE

SHAWINIGAN CARBIDE

SHAWINIGAN PRODUCTS CORPORATION
EMPIRE STATE BUILDING
NEW YORK 1, N. Y.

"Tank-Well" WRENCHES
For Acetylene Tanks



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SQUARE AND ROUND CAST IRON WELDING RODS AND ELECTRODES
"Flux-Well" Welding Fluxes
Sold Thru Leading Distributors
THE CHICAGO HARDWARE FOUNDRY CO.
"Dependable Since 1897"
NORTH CHICAGO, ILLINOIS

ROBERT K. HENDERSON has been appointed manager of sales, plastic pipe, by National Tube Division of U. S. Steel Corp., Pittsburgh. Succeeding him as manager of market development is SAMUEL W. VERNER.

* * *

WILLIAM L. LUTES has been named manager of the hard surfacing department, Electrode Div., The McKay Co., Pittsburgh. He will be in charge of development and application research of hardfacing electrodes in the York, Pa., plant. A member of AWS and ASM, Mr. Lutes previously served as metallurgical engineer and technical sales representative for the company. Before that he was a welding engineer for Cooper-Bessemer.

* * *

ROBERT M. MAHONEY has been appointed assistant to manager, Industrial Relations Dept., Union Carbide and Carbon Crop., New York City.

* * *

Harnischfeger Corp., Milwaukee, recently announced the appointments of two district managers in its Philadelphia office. W. R. O'MALLEY was named manager, overhead cranes and hoists, and JOHN J. MORAN was named manager, "P&H" excavators.

* * *

GEORGE H. MOREL has been appointed district engineer for the construction and maintenance department of American Brake Shoe Co. in the Chicago area.

"THINK THEY'LL EVER INSTALL AUTOMATIC WELDING MACHINES AROUND HERE, JOE?"

NO MATTER WHAT METALS...

there's a GB silver brazing alloy and flux combination that will *Speed Your Production!*

SILVER
COPPER
BRASS
STAINLESS STEEL
BRONZE
STEEL
NICKEL
CHROME ALLOYS
GOLD
TOOL STEEL
CARBIDE
INCONEL
ETC.

Every day more and more fabricators are learning that GB Silver Solder with GB Flux makes an unbeatable production team for low temperature brazing.

From the GB line of six standard silver solders you can select the one which will fully meet your production specifications. Yes, with GB Silver Solders you get sound, low-cost joints on virtually any ferrous or non-ferrous metal.

GB Standard Silver Solders:

GB No. 50 Silver Solder, melting range 1160-1175°F
GB No. 50N Silver Solder, melting range 1240-1260°F
GB No. 45 Silver Solder, melting range 1125-1145°F
GB No. 41 Silver Solder, melting range 1125-1160°F
GB No. 35 Silver Solder, melting range 1130-1270°F
GB No. 31 Silver Solder, melting range 1130-1300°F

For special jobs where special silver solders are required, GB offers you competent technical assistance, backed by over 80 years of experience in alloying and refining precious metals.

GB FLUXES

The physical properties and appearance of a brazed joint are controlled to a large degree by the flux which is used. For this reason it will pay you to team-up GB Flux with GB Silver Solder — they were developed to produce maximum results when used together.

GB DATA BOOK

Here's real factual data on all of the important phases of low temperature brazing. You can get a free copy from your GB Distributor — Write us and a copy will be forwarded to you.

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MARK A CENTER LINE
at any angle

DIAL SET 45°

TO ESTABLISH AND MARK a point at any degree of angle on shaft, pipe or tube without numerous calculations or "cut and try" methods use the Boyce Centering Head. It's a must for welders, machinists, pipe fitters and boilermakers because it is *absolutely accurate* and saves time. Small enough to fit in your pocket, it weighs only 9 ounces. Order yours today or write for information.

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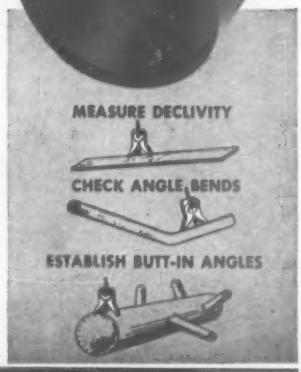

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IMPERIAL
GOGGLES

EyeGard "IMPERIAL" goggles are recognized as the finest made for comfort and protection . . . yet they are priced to save you money! Six styles — Cover-all and Regular. Write now for literature and prices.

- Uses standard 50 mm round lenses
- 22% larger than ordinary goggles
- More ventilation through cup slots — no fogging of lenses
- Feather-weight rims and side shields
- Face shaped contour to fit snugly, comfortably
- Available with or without metal adjusting top bar

#500 Welders Cover Goggles with baffled side shields

#502 Chippers and Grinders Cover Goggles, clear plastic with perforated side shields

AMERICAN INDUSTRIAL SAFETY EQUIPMENT COMPANY
1301 LAKESIDE AVENUE CLEVELAND 14, OHIO
Division of The Burdett Oxygen Company, Cleveland, Ohio

30 YEARS AGO

(Taken from THE WELDING ENGINEER *of December, 1924)*

"WHY the Flux-Coated Electrode?" is the title of an article in this issue by C. J. Holslag, of Electric Arc Cutting and Welding Co. It lists the advantages to be gained through protection of electrode metal.

—30 YEARS AGO—

THE "hows" and "whys" of aluminum welding are explained in this issue by a shop weldor, S. W. Henderson.

—30 YEARS AGO—

THE lead editorial this month lists the greater possibilities of welding and cutting in the building industry and asks that everyone boost their use even moreso than in the past.

—30 YEARS AGO—

G. E. EMMONS has left General Electric Co., Schenectady, N. Y., after 40 years of service with that firm and its predecessors.

—30 YEARS AGO—

THE Gibb Instrument Co., Bay City, Mich., has changed its name to Gibb Welding Machines Co.

—30 YEARS AGO—

CANADIAN section of Compressed Gas Manufacturers' Association held its fourth annual meeting on Dec. 2 in Toronto.

—30 YEARS AGO—

How electric welding appliances are used in the manufacture of saw blades and automobile rims and doors is described in this issue.

—30 YEARS AGO—

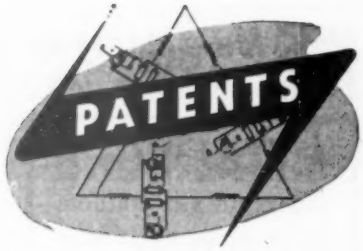
ANNOUNCEMENT was made of the winners in a welding photograph contest sponsored by The Bastian-Blessing Co., of Chicago. First prize went to The Balderson Welding Shop, Wamego, Kan. Awards were made primarily on the merits of the pictures as working shots of typical welding jobs, rather than on the merits of the work itself.

—30 YEARS AGO—

FOREIGN need for accurate regulators and greater operating skill is expressed in an article entitled "Eliminating the Oxygen Waste."

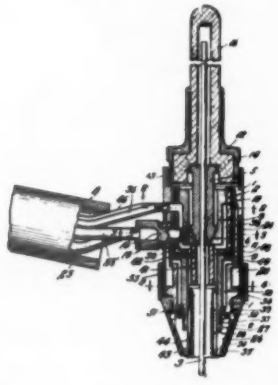
—30 YEARS AGO—

IMPORTANCE of the operator and his training is stressed by Robert Siemer, of Allan Mfg. & Welding Co., in "The Electric Arc in the Job Shop."



Inert-gas welding

2,686,860. MORTIMER P. BUCK, Westfield, N. J.; CECIL F. CRUMBLEY and ERNEST F. LEABERRY, Huntington, W. Va. Assigned to The International Nickel Co., Inc. Filed Nov. 19, 1952. Granted Aug. 17, 1954.



An arc-welding process using inert shielding gases is covered by this patent. An arc is struck between an electrode and the work to provide a weld zone. A laminar ring-shaped stream of helium gas is directed to surround the electrode and blanket the metal in the weld zone. A secondary similar stream of hydrogen gas is directed to envelop the helium at such an angle that no appreciable admixing of hydrogen and helium occurs in the arc zone. This is said to protect the helium against air contamination, thus eliminating substantially oxidation of the weld metal and the resulting high porosity.

* * *

Recovering acetylene

2,670,810. WILLIAM S. DORSEY, Fullerton, Calif. Assigned to Union Oil Co. of California, Los Angeles. Filed Jan. 21, 1952. Granted March 2, 1954.

A process for recovering acetylene from a gas containing the same in admixture with ethylene is the subject of this patent. The gas is scrubbed with a solvent that essentially comprises a compound selected from the class consisting of N-formyl-pyrrolidine, N-acetyl-pyrrolidine, N-formyl-piperidine and N-acetyl-piperidine.

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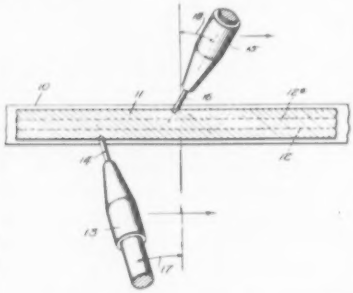
Submerged-arc welding

2,667,559. PERRY C. ARNOLD, Chicago. Assigned to Chicago Bridge & Iron Co. Filed May 4, 1951. Granted Jan. 26, 1954.



This patent concerns a process for submerged-arc welding of a horizontal joint between upright plates. A carriage to carry a welding head along the joint is mounted on the upper plates. The carriage's rate of travel is correlated to the fusion of an electrode, which it carries, to deposit a weld bead larger than the electrode. The electrode is directed downwardly and rearwardly toward the joint to permit expanding gases to carry metal being deposited toward metal previously deposited. It is directed upwardly in the joint into freezing contact with the upper plate. The deposited weld bead is thus fused to both upper and lower plates. The bead has a root width smaller than its outer width. This provides cooling of the bead from the root outwardly, thus avoiding faults in the deposited metal.

* * *

Soldering iron

2,658,983. HARRY W. TALBOT, San Francisco. Assigned to Kelso Norman, San Francisco. Filed May 14, 1951. Granted Nov. 10, 1953.

An electric soldering iron with a hollow handle and a hollow shank in the head is covered by this patent. Electric lead wires extend through both shank and handle to an insulating terminal plate in the handle. The handle is open at both ends, with the shank extending into one end. The plate is inserted through the opening in the opposite end. The plate end engages a notch in the adjacent end of the shank to prevent twisting. A twin-bored insulation rod is enclosed in the shank, each bore containing a lead wire. The end of this rod extends beyond the end of the shank into a notch in the plate, with the bore holes directed along opposite sides of the plate. The handle is secured to the shank by a means that enables the former to be moved along the latter, exposing the plate.

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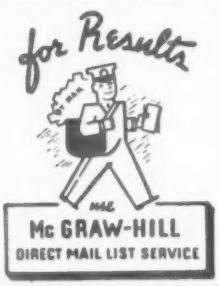

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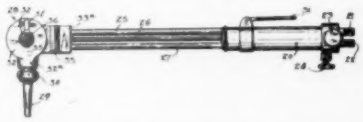
Oxyacetylene torch

2,670,789. CHARLES DIETERICH, Island Park, N. Y. Filed March 2, 1949. Granted March 2, 1954.



This patent concerns an oxyacetylene torch. A fixed head section connects to a source of oxygen and acetylene, and a movable head section is positioned adjacent one side of the fixed section and carries a flame-emitting tip. The sections have, formed in adjacent faces thereof, aligned concentric grooves defining separate chambers for oxygen and acetylene. The fixed head grooves are operatively connected to a source of oxygen, the grooves in the movable section to the flame-emitting tip. A means connects the head sections so that the tip's position can be adjusted with relation to the fixed head section. This means includes a rivet passing through the sections centrally with respect to the concentric grooves. This rivet has a circular portion extended through the fixed section and through a complementary hole formed in the movable section so that when rivet is turned in either direction the movable head is similarly turned. A washer is non-rotatively mounted on a non-circular portion extended the non-circular portion of the rivet adjacent to the outer face of the adjustable head section. A handle projects radially from this washer for turning the rivet. Also included is a means for releasably holding the movable section in a desired turned position relative to the fixed head section.

* * *

Control circuit

2,676,230. JOHN J. CZAJA, Detroit. Assigned to Weltronic Co., Detroit. Filed Feb. 23, 1951. Granted April 20, 1954.

A control circuit for a welder that requires a flow of coolant during its operation is the subject of this patent. A sequencing network controls the sequence of operation. Provided are a coolant-flow control means, a means for initiating an operation of the network, and a means actuated as a result of such an operation for actuating the coolant-control means to permit flow of coolant to the machine. A time-delay means, actuated by the final sequence of the network, holds the coolant-control means in its flow-permitting condition for a desired time interval subsequent to the completion of the sequencing operation.

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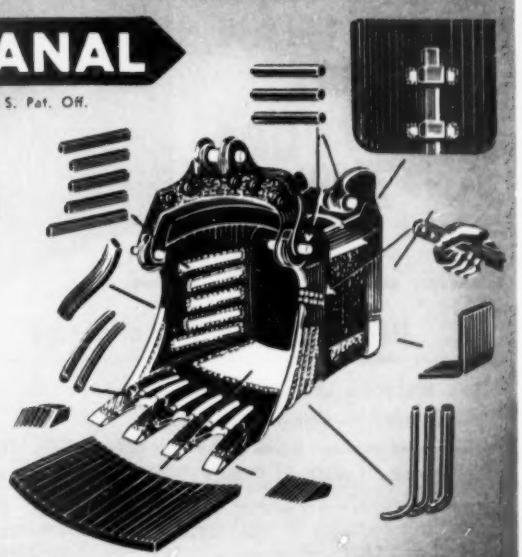

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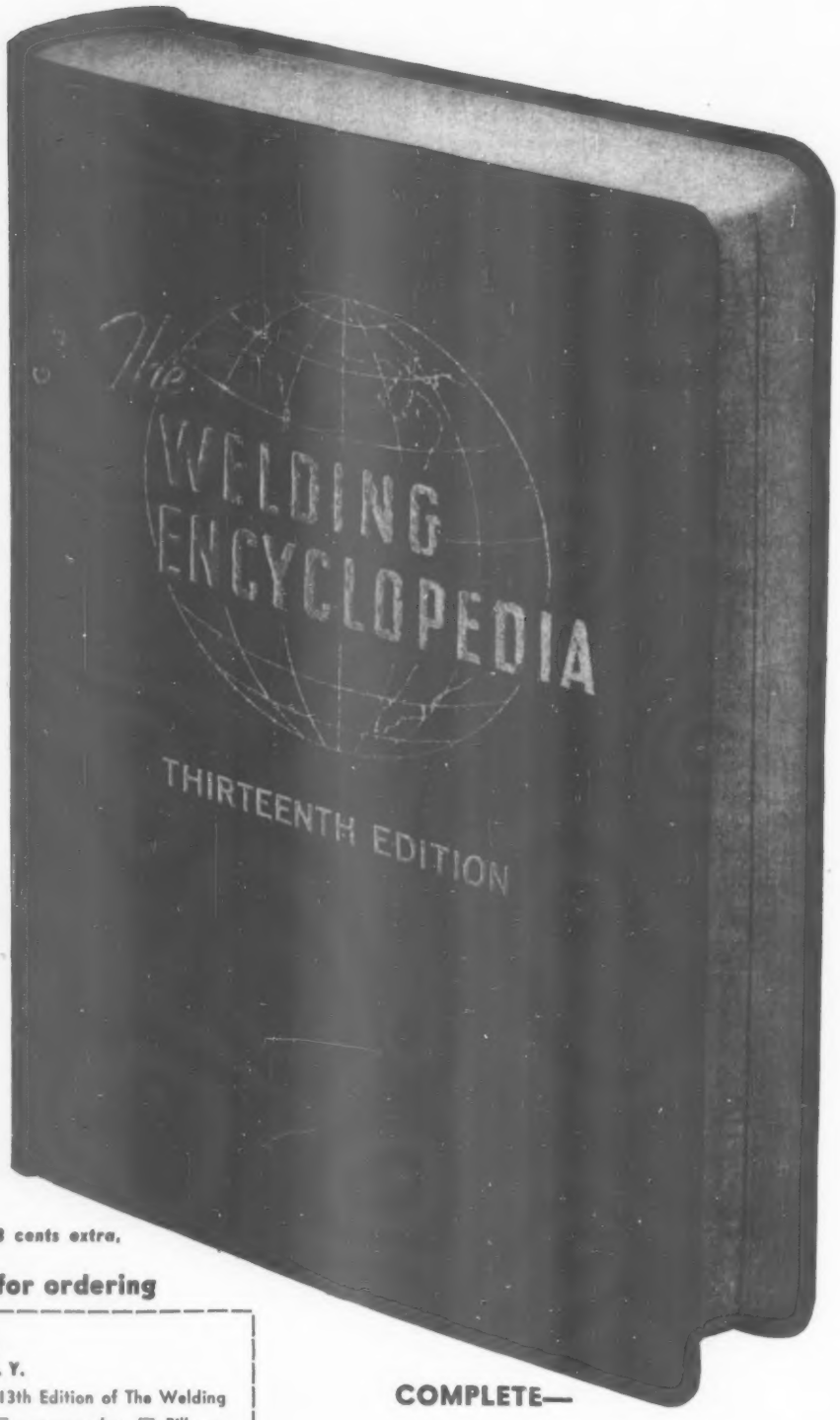

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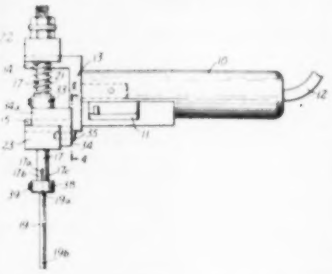
Portable welder

2,675,454. SAMUEL W. WARNER, Newark, N. J. Filed Nov. 20, 1951. Granted April 13, 1954.

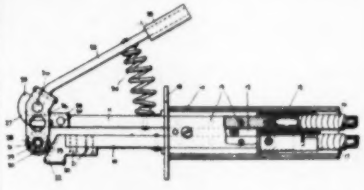


This patent concerns a portable welding apparatus that can be operated by hand. A pair of spaced supporting and guiding members is secured to a handle. A pair of electrode carriers is independently slidably mounted in parallel side-by-side position in said members. A spring means associated with the members and carriers exerts a constant bias on the carriers, tending to move them in one direction. A cooperating means associated with the members and carriers precludes rotational movement of the carriers. An electrode is secured to each of these carriers.

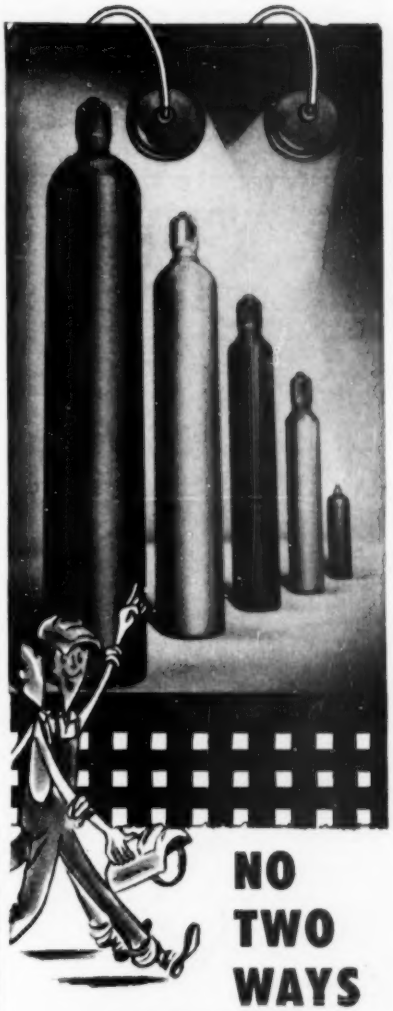
* * *

Electrode holder

2,676,231. IAN J. PICKERING, Birmingham, England. Assigned to The General Electric Co. Ltd., London. Filed Oct. 5, 1951. Granted April 20, 1954.



This patent covers an electrode holder for use with two-phase welding current systems. Two current-carrying arms flank each other. Included are connections for supplying current to the arms, solid electrical insulation between said arms towards one end and air insulation between the arms towards, and at, the other end. A surface is adapted to engage the bared end of one electrode of the double electrode at the air-insulated end of the arms. A lever has a surface adapted to engage the bared end of the other electrode. A fulcrum for the lever is on the other arm. Provided is a resilient means tending to urge said surfaces towards each other to engage and grip bared ends of electrodes between them.



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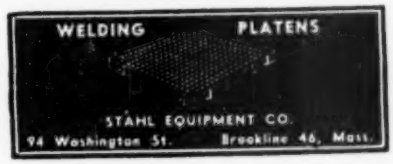
NO. 12 LENSES, ELECTRODE HOLDERS.
RALL SUPPLY CO. 51 E. 42nd St., N.Y.C. 17

FOR SALE
16 Curtis 3 stage hi-pressure air compressors, 1000 P.S.I. 1250 C.F.H. at 550 R.P.M.
1 Ingersoll-Rand model C-50 BW type 40, four stage hi-pressure air compressor. Delivers 3000 P.S.I. at 670 R.P.M. Complete with 50 H.P. motor and starter. 500 C.F.H. capacity.
7 Nordberg 3 stage hi-pressure compressors (4 air, 3 oxygen) upright type. Air compressors capacity 5000 to 6000 C.F.H. (260 R.P.M. at 1500 to 1600 lbs. operating pressure.) Oxygen capacity 1500 C.F.H. (140 R.P.M. at 2300 P.S.I.). All new and complete, less motor.
4 Complete new oxygen plants. 15000 cu. ft. per day capacity. 99.5% purity. Less power unit.
DYE OXYGEN COMPANY, INC. MFGRS.
3332 W. McDowell Road
Phoenix, Arizona

MULTI-ARC WELDING MOTOR GENERATOR SETS
1,000 and 1,500 Amps., G.E., West., Century, Synchronous and Squirrel Cage Drives, Complete with Controls.
Large Quantities. Inquire for Our Special Low Prices.
EMPIRE ELECTRIC CO., INC.
5200 First Ave., Brooklyn 32, N. Y.

OXYGEN PLANT
200,000 cu. ft. or 10 tons per day high purity, operated until March 1, 1954 consisting of, 2 oxygen compressors, driers, gas holder, pressure banks, etc., also trailers, tractor, buildings and land. All in excellent condition.
DELTA OXYGEN COMPANY
Sparrows Point, Baltimore 19, Md.

50% DISCOUNT ON WELDING OR SHOP CAPS
Made of brightly colored duck, sanforized and washable. Retail price $1.00. Order a trial dozen. Satisfaction guaranteed.
LOUISIANA WELDING SUPPLY CO.
1931 Plank Road, Baton Rouge, Louisiana



STAHL EQUIPMENT CO.
94 Washington St. Brookline 46, Mass.

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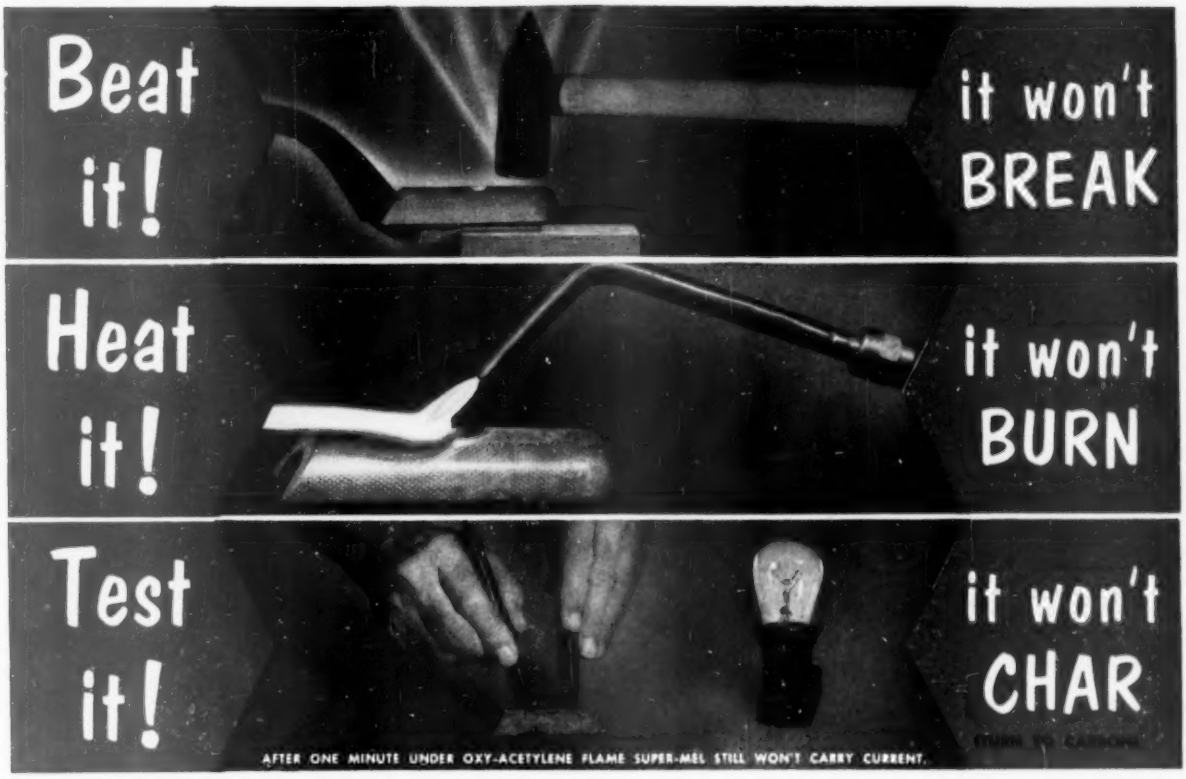
ONLY TWECOTONG HOLDERS HAVE "SUPER-MEL" INSULATION



...How about the insulation on your holder?

Electrode holder life is based on the quality of the materials that go into it, and the workmanship that produces it. Insulation tops the list of essential parts and has the greatest bearing on maintenance costs.

Only TWECOTONG Electrode Holders have "SUPER-MEL" insulation which is composed of thirty layers of continuous filament glass cloth impregnated with pure Melamine resin. Heat it for a full minute with the searing 6,000° flame of an oxy-acetylene torch. It won't deform and it won't turn to carbon which causes other insulation to carry current and short-out. Beat it with the full force of a heavy hammer. Its laminated strength will withstand repeated blows and prove its ability to take any normal shop or field abuse. Make these same tests on any other insulation on the market and you will see why so many users have switched to TWECOTONG with patented "SUPER-MEL" insulation.

Only a quality product can invite comparison. TWECOTONG "Rod-Rated" Electrode Holders are made in a full range of 6 rod sizes. *They are designed to hold an electrode tight* for greatest electrical and mechanical efficiency – Engineered for safety, comfort and performance. They have the longest life and cost no more. Be sure your next holder is a TWECOTONG.

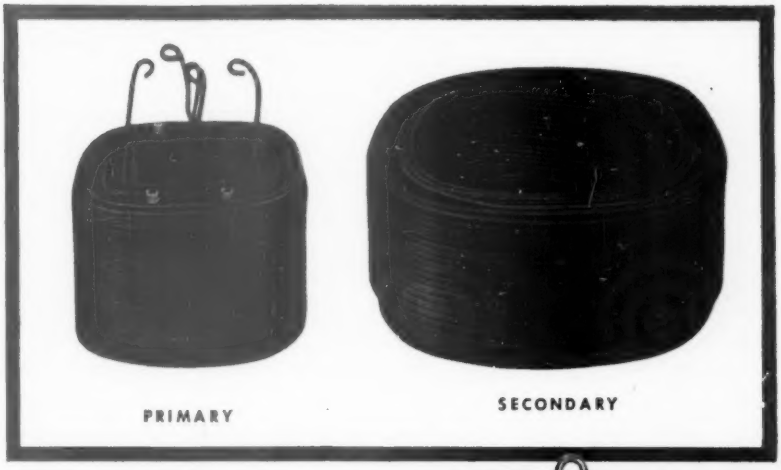
SEE YOUR LOCAL WELDING SUPPLY DISTRIBUTOR

WRITE FOR TWECOLOG *Data and prices on the complete TWECO line of electrode holders, ground clamps and cable connections.*

More copper in the coils

When buying a welder, find out for sure how much copper is in the transformer coils... that's the heart of a welder's performance.

For example, in A. O. Smith's 400-amp heavy-duty a-c welder, the coils contain 156 lbs. of high-quality electrical grade copper — 63 lbs. in the primary coil, 93 lbs. in the secondary. This is far more copper than you'll find in any comparable welder.



adds years of life

TO THE A. O. SMITH HEAVY-DUTY WELDING MACHINES

- **GENEROUS** use of expensive copper, combined with job-proved coil design, promotes cooler operation . . . protects against insulation breakdown . . . doubles machine life.

- **ACTUALLY,** the Heavy-Duty has a temperature rise of only 55° C compared to 90° C rise allowed by NEMA standards for glass insulated welders.

- **DELIVERS** a full 75 open circuit volts for faster, smoother arc action at all current settings. Welds smoothly with low hydrogen electrodes . . . easy strike . . . no stickiness nor pop out.

Through research ...a better way

A.O.Smith
CORPORATION

WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
INTERNATIONAL DIVISION: MILWAUKEE 1